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and Maintenance of Way

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Contents

Watering Stock in Transit

MANY railroads depend upon the water tank used by locomotives for supplying water to stock in transit. A simple system of piping that is an improvement over the goose neck attached to water tank both in time required for operation and amount of water used is being used by some roads successfully. The piping is generally installed by the water service men of the railroad and consists of a 3-inch main lead from whatever water source may be convenient to a small pit located adjacent to the track upon which stock is generally watered.

This pit is about 3 feet deep and is generally walled in with concrete, while the bottom is filled with porous material, such as cinders, gravel or crushed stone, so waste water may drain away. The main, by use of elbow, is projected vertical to about 8 feet above the top of rail and about the same distance out from the track. A 1½-inch reducing elbow is attached to the top of the pipe as well as a 1½-inch reducing tee, is inserted 5 feet lower to provide for two 1½-inch pipes 6 feet long attached at their center so as to be turned in a vertical plane and serve as a nozzle for directing the stream of water. Both pipes or nozzles are flattened at one end so as to deliver a flat stream of water, while the other end is capped and used by operator in directing the stream. Valves are so arranged that one or both nozzles may be used at a time to meet conditions, whether stock is in single or double deck cars. This affords a convenient and rapid method of watering and drenching stock in transit without the waste of unnecessary water. The nozzles may be turned in a vertical position when not in use and clear all trains. The main valve controlling the water is located in the pit and is operated from a hand-wheel mounted on a vertical rod to the stem of the valve. The object of the pit is to guard against frost in winter and all piping as well as the pit is well covered. The pit is commonly called the frost box and in cases of extreme cold weather the pipes can be drained and abandoned until warmer weather.

On roads handling considerable stock, and where this system is used, these plants are installed about 25 to 50 miles apart according to conditions. The Boston and Maine and Lake Erie and Western Railroads are among the roads using them with success.

Distribution of Railroad Expenses

THE distribution of railroad right of way expenses very frequently depends upon the judgment of individuals, who are largely governed by local conditions, and as the dividing line between improvements, additions and betterments cannot be clearly drawn it would seem pertinent that any step toward bringing about uniform decisions would be in keeping with modern advancement. There are numerous items of expense that could be classed one way or the other, according to the view point taken, so that the final decision often favors apparent arbitrary action.

The problem of obtaining a general set of rules and short formulas, to serve as a universal guide is one of no small importance. It is essential to record this opin-

ion at the start so as to forestall adverse criticism, claiming that any attempt to bring some degree of order out of the chaotic system of existing rulings, results in reducing surplus earnings, to the temporary detriment of stockholders. In some cases charges are liberally made to capital thereby calling for an increase eventually in the capitalization of the road.

As an aid to those contending with this problem the following classification is presented as being in accordance with good practice.

Classify all maintenance of way expenses under two general heads, namely, "Repairs" and "Improvements."

"Repairs" to cover all expenses for the regular maintenance of property and is sub-divided into, "Current Repairs," "Contingent Repairs," "Special Repairs," and "Extraordinary Repairs."

"Improvements" to cover all expenses that create a specific permanent physical improvement, tending to increase the value of the railroad property and is sub-divided into, "Betterments" and "Additions."

"Current Repairs" are to consist of regular constant annual recurrent expenditures for repairs and sundry minor work required regularly from year to year to maintain the efficient condition of the property. Also the expenses required to keep the track and structures in safe operating condition, as well as all charges for superintendence, labor, materials and sundry items in the nature of fixed expenses. Such fixed expenses to include all customary material purchases necessarily required for the regular maintenance of property, provided such charges are not in the nature of large expenditures incurred for unusual, unforeseen contingencies for large special requirement not distinctly repair work or for extensive non-annually recurrent repairs or renewals.

"Contingent Repairs" to consist of unforeseen expenditures due to severe storms, floods, fire, accidents and casualties of all kinds necessitating expensive emergency work. Also all subsequent extensive repairs or renewals, provided such work is not of such a comparatively small nature as to belong properly to the uniform and routine work of the regular maintenance of way forces.

"Special Repairs" to consist of minor items necessarily permanently chargeable to maintenance account, even if not distinctly repair work, but such items, if charged to current repairs would tend to vitiate the comparative statistical value of the current repair account. Also such other items that are too small to warrant being charged to extraordinary repairs or classed as a permanent improvement of the property.

"Extraordinary Repairs" to consist of large non-annually recurrent repairs or extensive renewals in the nature of maintaining the property, provided such work does not constitute a betterment or addition.

Under the main division "Improvement," the sub-head "Betterment" to consist of any permanent betterments to the existing property constituting a permanent physical improvement, tending to increase the value of the railroad property as a whole, as well as the charge to cover difference in cost of the new improved structure and the estimated cost of replacing the old unimproved structure. Also to include the renewing of bridges such as strengthening for increased loading, as well as rebuilding structures, auxiliary appliances, etc., on a larger scale. The increase of track mileage due to rearrangement of yard and track layouts, stone ballasting, etc., provided such work does not consist of extensive repairs, such as changing and remodeling existing facilities, is also included under heading of "Betterments."

"Additions" to consist of any permanent addition to the existing property constituting a distinct separate, new, permanent, physical improvement, tending to increase the value of the railroad property as a whole such as new roadbed, tracks, bridges, buildings or other auxiliary appliances and fixtures, etc., provided such addition is not in the nature of repairing, renewing, replacing, changing or remodeling any existing facility.

Comparison of Railway Track of the Past with the Present

A NUMBER of good authorities believe there is just as good steel being put into rails today as there was 20 or 30 years ago and the cause of the numerous apparent rail fractures is the increased service that is expected of them. About 1880 a large western trunk line received a consignment of rails that after being tested were considered poor on account of being soft. These rails when put in service received unusual attention for a short time with the result they gave wonderful wear and were still in service 25 years later. At the end of this time they began to break on account of brittleness. In testing various lengths of these rails for deflection between supporters, it was found they would only deflect a trifle before fracture, while taking an adjacent piece of the same rail and planing off about 1-32 inch from the top of rail it was found that the rail could be bent nearly to 90 degrees before fracture. This leads to the belief that the statement made regarding a hard skin forming on rail due to wheels continually passing over, has some foundation.

Authorities seem to agree that there is little substance in the theory of crystallization of rail or steel. Steel is a crystalline material to begin with but experience has taught that rails get brittle with continued use. About 20 or 30 years ago it was a common thing to find rails containing as high as .13 to .15 phosphorous that gave wonderful service while today such a high percentage of phosphorous is exceptional. Of course, it will be remembered that the proportions of phospherous through-out the rail varies considerably and in making analysis it is essential that it be known where samples are taken.

Unbalanced locomotives and their harmful effects on the track are no new propositions for as long ago as 1880, there was a case where 5 miles of track on a hill was found kinked downward about 1/4 inch and in some places increased to 1/2 inch every 16 feet. The cause of this was immediately investigated and found to be an unbalanced locomotive that had passed over this track the night before running down grade. Upon examining the engine after the trip, the conditions found showed evidence

of excessive pounding. It is interesting to note that this 60 pound rail stood that kind of punishment without fracture and in the majority of cases a recurrence of this performance at the present date, with the increased weight of equipment, etc., would result in rail fracture.

In the manufacture of steel rails the heat treatment and the temperature at which the ingot is rolled into rail is one of great importance and becomes more evident with the increase of the carbon, silicon or manganese in the steel. In this regard it is a question whether any improvement has been made within the last twenty years. Should the chemical composition of the present manufactured rail be in error, it would seem that the most efficient way to bring about correct results is for the rail manufacturers and railroad engineers to combine their efforts in the common cause.

Track Elevation at Chicago

C. & N. W. R. R.

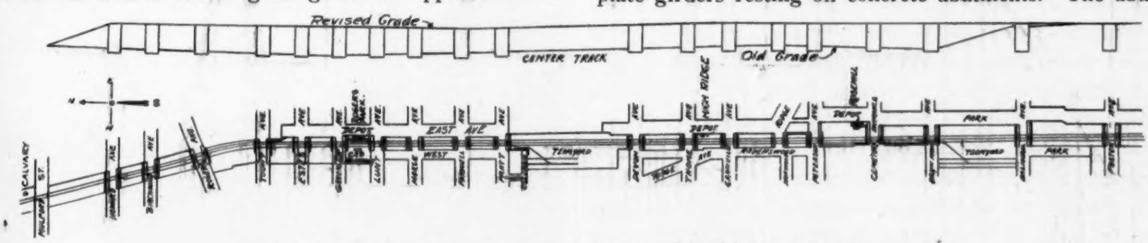
THE Chicago & North Western Railroad is extending their track elevation in Chicago with unusual rapidity from Balmoral Avenue north to Howard Avenue, a distance of about 3 miles, in accordance with City ordinance providing that tracks be elevated in this section. The roadway over the district elevated consists of three main tracks as far north as Howard Avenue where the tracks diverge into two. There will be no change in the alinement of the roadway and the revised grade established is illustrated herewith.

The work of elevation was commenced by raising the center track between Lunt and Greenleaf Avenues on falsework to grade and then filling each way. The average track elevation for the entire distance is about 13 feet. On account of not having sufficient width of roadway between Lunt and Greenleaf Avenues to provide for depot, platform, three tracks and the additional width required by slope of fill, it was thought advisable to erect falsework under center track and when other tracks were raised to grade the middle track could be filled around falsework, all of which would act as a part of the permanent roadway. After the entire center track, with the exception of a short distance at Rose Hill, was brought to grade and surfaced such that trains could run, the work of filling for the east and west track was begun. Coarse gravel, received from pit at Cary, Ill., on the Wisconsin Division, a distance of about 38 miles, was used for the fill. A small amount of fill was procured from the reduction of several knolls adjoining the tracks as well as reducing the grade for approach to the various subways to 3½ percent as maximum. The elevation of these tracks for the entire distance of three miles will require about 346,000 cubic yards of fill.

As the railroad company cut the grade on the various roads affording an easier approach to the subway and leaving the road in the center of each block considerable higher, the city joined in with the work of reducing the center portion of the street thereby making streets of uniform grade. New water mains are also being laid while streets are in disorder. A 100 ton locomotive crane, standing on the center elevated track, was used in picking up segments of the east and west track, usually of rail length, and placed them to one side until fill was made, when the crane replaced the segments making track continuous. Loose ties in bunches of ten or fifteen were also handled in this way.

FALSEWORK OVER GREENLEAF AVENUE. TRACK ELEVATION AT CHICAGO C. & N. W. R. R.

Pile trestle subways were erected at each road crossing and it is the intention to replace these in the future with plate girders resting on concrete abutments. The abutments for the cemetery entrance subway at Rose Hill are to be constructed of stone to coincide with stone structures now at the cemetery.



GRADE AND ALINEMENT MAP. TRACK ELEVATION AT CHICAGO, C. & N. W. R. R.

A plan and sectional elevation of a typical concrete abutment for subway is herewith presented. In one or two cases concrete center piers were constructed where

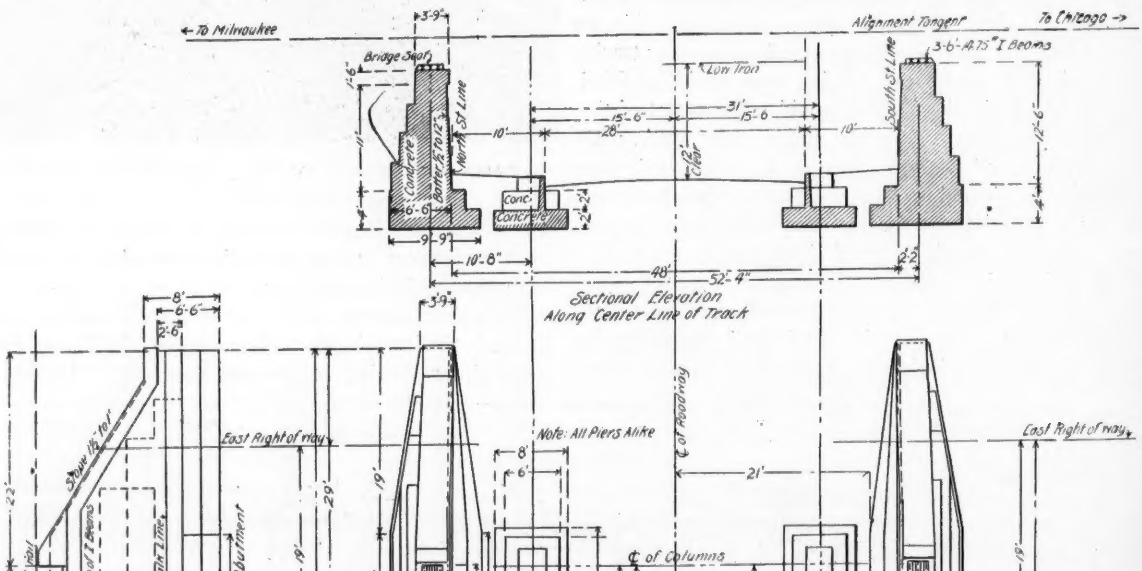
the span was exceptionally large. The concrete used, was of the following proportions; for foundations 1 : 3 : 6, for work above foundations except bearing surface 1 : 3 : 5 and for the upper six inches of bearing surface 1 : 2½ : 4, The stone used in concrete was required to pass sieve having a ½ inch mesh, while all dust and clay was to be removed by screening. The bridge seats are reinforced by 3 six inch 14.75 lb. "I" beams affording a substantial base. The average pressure for abutments as well as maximum toe pressure is 3,100 pounds per square foot while the average pressure for piers is 3,800 pounds per square foot of bearing surface. The abutments are built to serve three tracks laid at 13 foot centers. The concrete retaining walls were built in the year 1906 in advance of the spring track elevation work. There are 18 subways to be put in between Balmoral Avenue and Howard Avenue and it is estimated that it will require about 7,590 cubic yards of masonry to complete the entire number of piers and abutments. As Howard Avenue is the dividing line between Chicago and Evanston the north abutment of Howard Avenue subway is in Evanston.

A scene during elevation of the brick depot at Rogers Park is presented herewith and shows the method of constructing the additional foundation required of stone and brick. Directly west of tracks at Rogers Park depot is a macadam driveway for cab service, etc. A small "warm" house is also provided near the west entrance to elevated track to protect passengers and cab-men from weather.

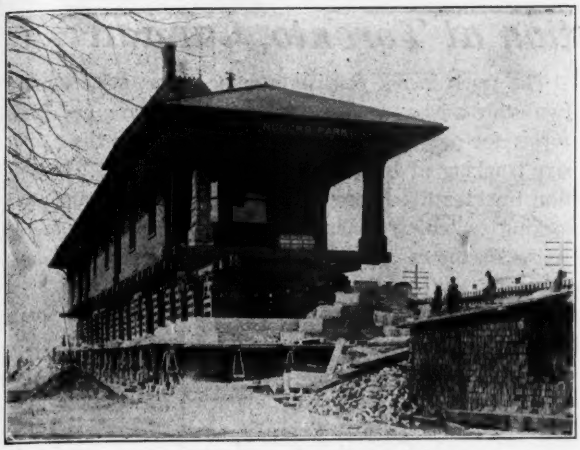
LOOKING SOUTH FROM KENILWORTH AVENUE. TRACK ELEVATION AT CHICAGO, C. & N. W. R. R.

A new depot is to be built at High Ridge, that is to replace the structure now used at that place for station purposes. Rose Hill is also to receive a new depot built of stone, in keeping with surrounding structures, that will aid the appearance of the cemetery entrance.

The work of constructing the concrete subway abutments has been started at Morse and Thome avenues and this as well as the balance of the work will be rushed through to completion. The concrete for this work was mixed by a mechanical plant, mounted on wheels, and the materials of construction are in adjoining coal cars; all of which are moved from place to place by a loco-



DETAILS OF SUBWAY ABUTMENTS. TRACK ELEVATION AT CHICAGO, C. & N. W. R. R.



ELEVATING DEPOT AT ROGERS PARK. TRACK ELEVATION AT CHICAGO, C. & N. W. R. R.

motive. The car containing the concrete mixing machinery is spotted directly over the subway where abutments are being built and mixture of concrete is conveyed to abutments by gravity. The cars containing crushed stone, sand and cement are directly next to machinery car and these materials are loaded in wheel barrows and conveyed by hand to the mixers over a temporary board path built on top of coal cars. It is not expected that the steel work will be ready before the latter part of this year or the fore part of next.

All industrial spurs turning out from the main line in this district are removed and all teaming will be done from two team yards located between Pratt and Devon Avenues and Bryn Mawr and Balmoral Avenues. The team yards are located on the west side of the tracks located conveniently, and are paved affording easy access to cars. Heretofore there was a spur in front of cemetery entrance at Rose Hill and this improvement will do away with this siding as well as the liability of seeing box cars standing in the vicinity of the cemetery entrance and marring appearance of environment.

The work of track elevation is under the supervision of Mr. C. S. Hall, Engineer of Track Elevation, Chicago.

LOOKING SOUTH FROM RIDGE AVENUE. TRACK ELEVATION AT CHICAGO, C. & N. W. R. R.

School of Railway Engineering and Administration

THE University of Illinois has recently added the School of Railway Engineering and Administration to the studies already offered that will provide opportunities for men desiring an education along railroad lines. The courses established are Railway Civil Engineering Railway Electrical Engineering, Railway Mechanical Engineering and Railway Administration and it is the desire, through the medium of one of these courses that men become efficient workers in the financial, traffic, and operating departments as well as in the engineering departments of both steam and electric railways.

The University authorities have issued a pamphlet describing the requirements of these courses and a part of which is herewith annexed.

In the employ of the railroads of the country there are approximately twelve thousand persons who are classed as officials. Of this number a considerable proportion occupy positions whose powers and duties require the possession of more than average ability, and such positions must always prove attractive to ambitious men.

Ever since such graduates have been available the railways have recruited many of the men for their engineering departments among the graduates of technical schools; and the success of these men has amply justified the procedure here as in other fields of industry. The rapid growth of railway organizations, with the attendant increase of responsibility resting upon those in their service, has made more necessary a proper preliminary training for all branches of this work; and each year has seen an increase in the number of men selected for this service from our engineering schools.

Within recent years there has developed a tendency to select men for higher executive positions from the departments of maintenance of way and of motive power instead of taking them, as heretofore, almost exclusively from the traffic and operating departments. This tendency not only renders more urgent the necessity of special training, but, on the other hand, makes more attractive the service in the engineering departments.

There are many reasons why similar specialized preliminary training should prove equally desirable for those who expect to enter the non-technical departments of railways, where, in the administrative positions, responsibilties are frequently greater; and it is probable that here, as in the engineering departments efficiency and the chances of ultimate success would be furthered by such training. It is only recently, however, that there has been available in this country any except the most elementary and limited education in preparation for commercial work, and where courses of commerce have been established in our universities, they have been usually arranged without reference to railway work.

All these considerations point toward the desirability of special recognition of the needs of railways and of prospective railway employees in our educational institutions.

Proposed New Union Station at Toronto, Canada

THE Grand Trunk and the Canadian Pacific Railways have recently completed plans for a new union passenger station at Toronto, Canada, and is to occupy a site close to the present station. The present station is bounded on the north by Front St., on the east by York St., on the south by Station St., and on the west by Simcoe St. A new street is to be opened up between Bay and Yonge Streets that leads into City Park. The estimated cost of new station and improvements is $2,000,000. We are indebted to R. S. Logan, Assistant to Second Vice President of the Grand Trunk Railway System for the following information and illustrations.

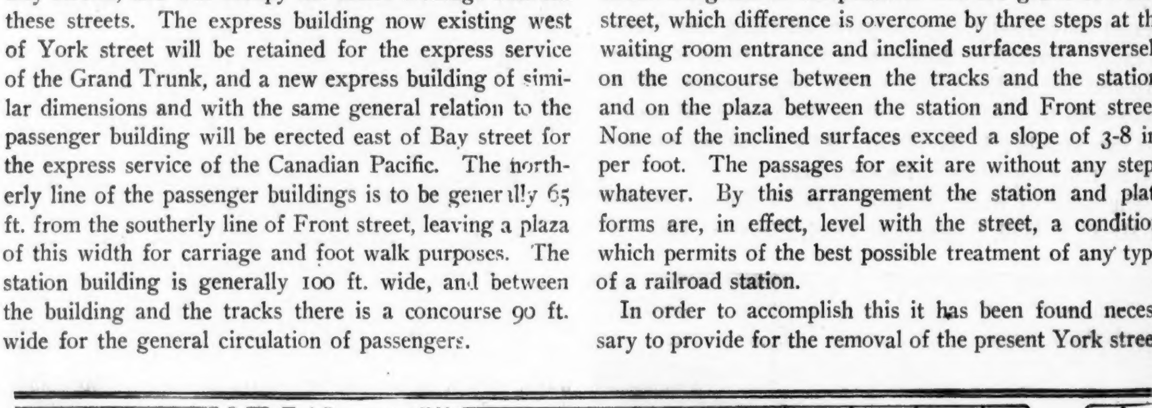
The track layout consists of nine through tracks and two stub tracks, so arranged that there are five platforms for passengers and two platforms for the exclusive trucking of baggage and express matter. The station tracks are connected up at each end with an interlocking switching system so that they properly join the tracks on the east and the two main tracks on the west, generally with double-track leads, to give the greatest facility to the train movements. The passenger platforms will be 1,400 ft. long, this distance being sufficient for the longest trains, though it may be increased if found necessary. They are about 20 ft. wide throughout.

The new tracks at a point opposite the center of the station will be 4 ft. higher than the present tracks, and the platforms are designed to be 8 in. above the top of the rail. This gives a difference of level of about 5 ft. between the grade of the platform and the grade of Front street, which difference is overcome by three steps at the waiting room entrance and inclined surfaces transversely on the concourse between the tracks and the station, and on the plaza between the station and Front street. None of the inclined surfaces exceed a slope of 3-8 in. per foot. The passages for exit are without any steps whatever. By this arrangement the station and platforms are, in effect, level with the street, a condition which permits of the best possible treatment of any type of a railroad station.

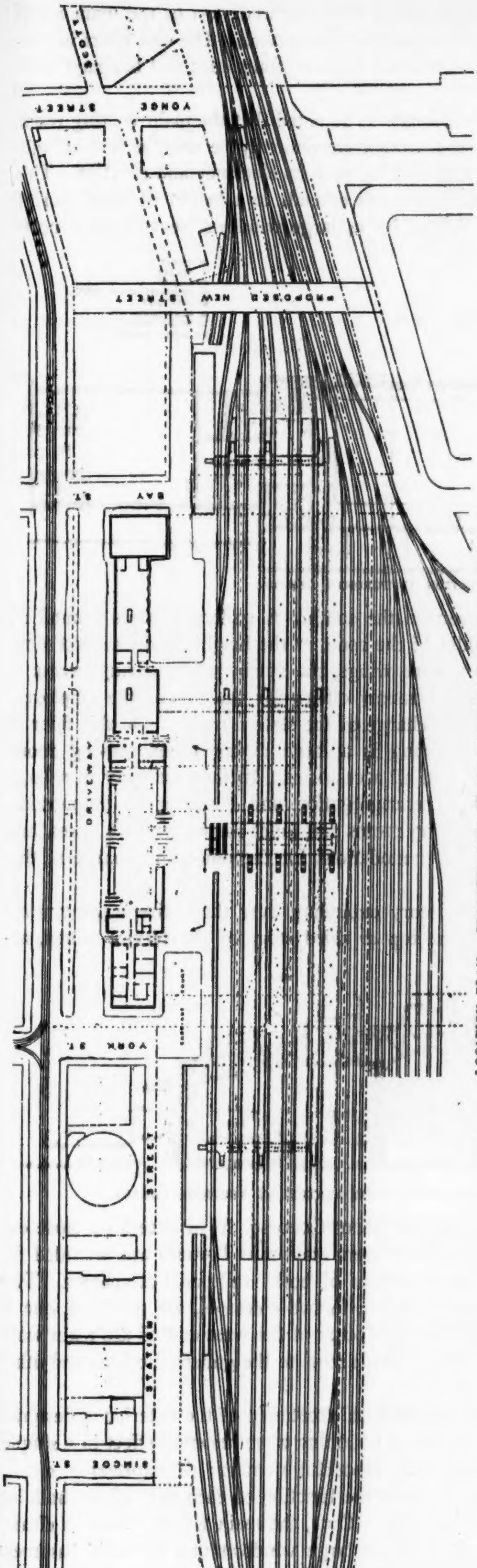
PROPOSED NEW UNION STATION AT TORONTO, CANADA.

The proposed passenger station building, including baggage buildings and service plant, are to be erected on the southerly side of Front street, between York and Bay streets, and will occupy the entire frontage between these streets. The express building now existing west of York street will be retained for the express service of the Grand Trunk, and a new express building of similar dimensions and with the same general relation to the passenger building will be erected east of Bay street for the express service of the Canadian Pacific. The northerly line of the passenger buildings is to be generally 65 ft. from the southerly line of Front street, leaving a plaza of this width for carriage and foot walk purposes. The station building is generally 100 ft. wide, and between the building and the tracks there is a concourse 90 ft. wide for the general circulation of passengers.

In order to accomplish this it has been found necessary to provide for the removal of the present York street



FIRST FLOOR PLAN. PROPOSED NEW UNION STATION AT TORONTO, CANADA.



LOCATION PLAN. PROPOSED NEW UNION STATION AT TORONTO, CANADA.

overhead bridge and to substitute for it an overhead bridge just east of Bay street. It is also suggested that this latter bridge can be made to take care of the traffic at the Yonge grade crossing, so that the necessity of a bridge at the latter street can be avoided. Foot bridges at any necessary point of crossing can be built without interfering with the raising of the tracks.

In order that it may not be necessary for any passenger to go upon any track at grade, and to make the station absolutely safe and fully up to modern methods and requirements, a subway 50 ft. wide is provided opposite the center of the station, so that any platform may be reached by means of easy stairways with landings. The total height of stairways for this purpose is about 10 ft. This method allows all trains to come to a stop directly opposite the center of the station, thus making the least distance for passengers to walk to and from the station and trains.

The baggage and express trucks are to be kept as much as possible on special trucking platforms, 10 ft. wide, which extend the whole length of the station and which are adjacent to four of the nine through tracks. On these four tracks it is intended that trains having the bulk of express and baggage matter will be run. The baggage and express trucks cross the track area by subways beneath the tracks and leading to the basement of the baggage and express buildings. The trucks will be raised and lowered between the subways and the platforms by means of electric elevators. There are three of these cross subways, one leading to the baggage room one to the express building at the east end, and one to the express building at the west end of the station.

A train shed roof will cover the main portion of the platforms and the concourse. It will be 800 ft. long by 315 ft. wide, covering about six acres. The main structure will be in three spans and there will be a connecting roof between the train shed and the station building. This roof will be a steel structure and will be lighted and ventilated.

At each end of the station concourse are spaces for a carriage court, for the accommodation of cabs, carriages and baggage transfer wagons, so that it will not be necessary to pass through the station building to get a carriage.

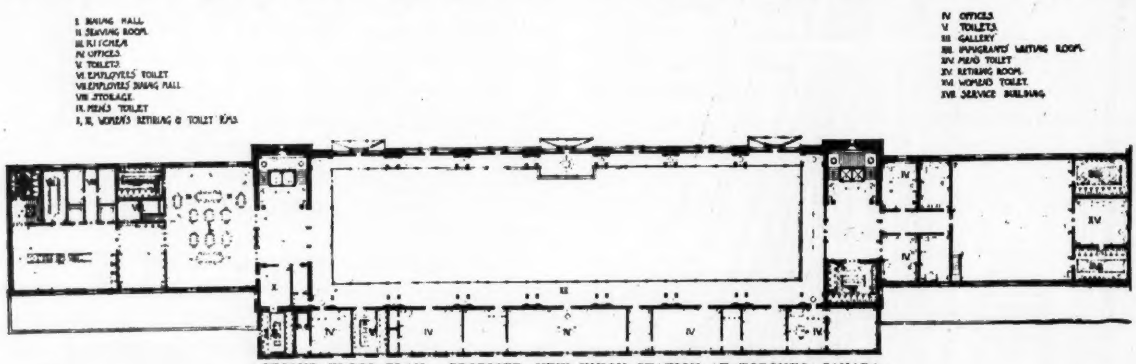
At the extreme easterly end of the station a service building is provided for supplying all heat, light, steam, hot water, compressed air, refrigeration, etc., for the use of the station building and trains.

The general layout of the station yards and grounds, including the approach tracks, does not interfere in any way with the present freight yards of either railroad company.

The station building is planned primarily with a view to convenience and spaciousness, and consists of a main central building with two service wings. In the main building, on a level with the tracks, is located the general waiting room containing 17,242 sq. ft., which is 5,000

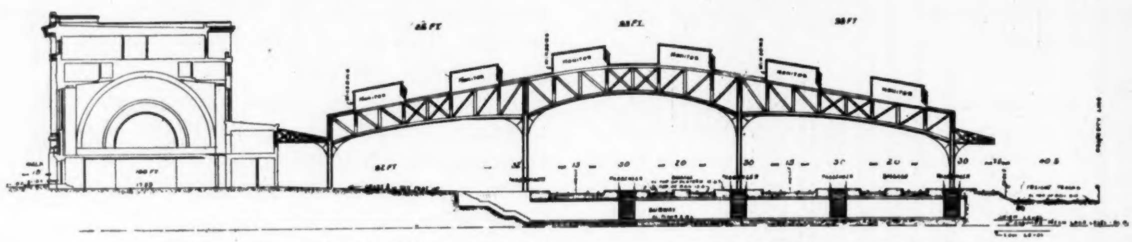
sq. ft. larger in area than the Grand Central Station of New York City, or the present station in Toronto. Access to the waiting room is obtained directly by three spacious openings containing nine doors each directly from the plaza, or Front street. Egress to the trains is obtained by three similar openings, containing each nine doors, leading to the concourse.

Ticket, telegraph and telephone booths, information bureau, news stands, ample parcel room and other conveniences are provided along the four sides of the waiting room, where they are easily accessible and visible.



SECOND FLOOR PLAN. PROPOSED NEW UNION STATION AT TORONTO, CANADA.

A broad passage at the east end leads directly to the baggage room, which is located in the east service wing. The area of this room, including the basement and first floor, is 28,000 sq. ft., or 15,000 sq ft. larger than the present baggage room, and 6,000 sq. ft. larger than the baggage room at the Grand Central Station of New York, which is one of the largest in the United States. A similar passage at the west end of the waiting room leads directly to the west service wing, in which are located waiting rooms for men and women, each provided with ample toilet accommodations, the women having in addition retiring rooms. Barber shop, boot blacks and other conveniences, together with a well-equipped, spacious lunch counter, are likewise provided in this section of the building.



SECTION THROUGH MAIN WAITING ROOM AND TRAIN SHED. PROPOSED NEW UNION STATION AT TORONTO, CANADA.

Spacious passages running north and south are placed at each end of the waiting room, between the waiting room and the baggage room on the east, and between the waiting room and service wing just mentioned on the west. These passages are intended mainly for exits, so that the traveling public, in arriving, will pass through and out without crossing the waiting room. Passengers departing can enter by the east passage, check their baggage and buy their tickets without confusion or delay.

Carriage courts both east and west of the main building are available for cab service. The east court is likewise available for transfer companies and baggage service.

It is especially to be noted that the main waiting room, as planned, cannot conveniently be used as a thoroughfare, which will increase its efficiency and comfort. This main waiting room extends to a height of three stories, and is lighted by 14 large windows, seven on the north and seven on the south. A gallery extends around all four sides of the room at the height of the second story of the service wings, the north gallery giving access to a series of roomy offices for the use of the employees directly in charge of the station traffic. On this floor in the west wing is a large dining room, serving room, kitchen and all accessories. In the east wing in a large hall for the segregation and handling of immigrants, with retiring rooms and toilet rooms for both sexes, and ample accommodations for the officers in charge of this service.

In the story extending over the entire waiting room and in the top or third story of the service wings, accommodations about 6,000 sq. ft. in excess of those existing in the present station in Toronto are provided for the general offices of both railroad companies. Two staircases, each with two elevators, are provided, one at the east and the other at the west end of the main waiting room, giving access to the galleries, offices and other service.

The architectural treatment of the exterior is designed with a view of obtaining a monumental effect in a simple, dignified and reposeful manner; of expressing clearly on the exterior the function of each part of the building on the interior. Thus, the main waiting room is clearly suggested by the large windows and the solid basement

treatment, the wings indicating clearly the subordinate function which they have to perform; so likewise the baggage and service buildings. The treatment will be maintained on the interior of the building on the same lines. The style of architecture is classic, and though inspired as to detail from the fine examples of the eighteenth century, is treated so as to be distinctly modern in its expression and to clearly indicate the purpose of the building as a whole, and of each part of the building as well. It is intended to build the exterior of some light stone.

Improvement Near Towanda, Pa., Lehigh Valley R. R.

THE Lehigh Valley Railroad has recently completed the erection of a long plate girder bridge over the Susquehanna River near Towanda, Pennsylvania, as well as reducing the curvature and grade of the adjoining track. A general view of this improvement as well as alinement and profile maps are illustrated herewith.

will justify money expended on improvement. With the aim of placing the Towanda depot in a better locality, several lines were projected and estimates made. The expense of additional right of way and longer bridge caused the idea to be abandoned and the revised alinement as illustrated was used.

The alinement of the approach of the old bridge is 7 degrees 30 minutes while that of the new bridge is 3 degrees 30 minutes. The total length of the new bridge from abutment to abutment is 1,801 feet and consists of 14 spans of deck plate girders approximating about 65 tons each. The length of span for each girder, with the exception of the east span, is 129 feet 6 inches long and 10 feet 1½ inches deep. The length of the east span varies on account of the angle at which the east abutment stands. The piers of the new bridge are closer together than on the old structure to allow the use of deck plate girders instead of truss spans. The masonry in the old bridge was built in 1865. The girders of the new bridge were erected by a cantilever traveler, thereby doing away

GENERAL VIEW OF NEW AND OLD BRIDGE OVER THE SUSQUEHANNA RIVER NEAR TOWANDA, PA. LEHIGH VALLEY RAILROAD.

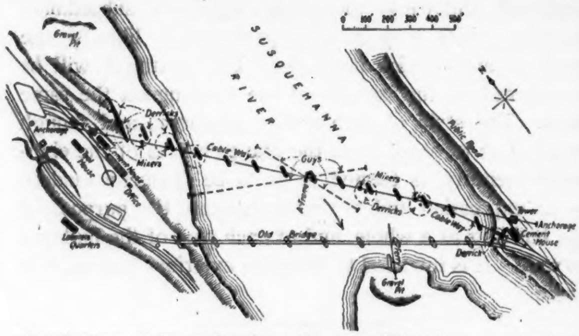
The distance between Towanda and Wyson is classed by the officials, as being the limiting point in rating engines as to their hauling capacity over the division on account of its heavy grade and sharp curvature. A profile of the roadway, shows the actual and equivalent grades in each case. Vosburg Tunnel where the conditions are such that there is but little opportunity for lowering grades, is considered another limiting point second to distance between Towanda and Wysox. It was decided that if the grades and curvature between Towanda and Wysox be reduced sufficient to make Vosburg Tunnel the limiting point, the engine hauling capacities would be considerably increased. The reduction in train mileage, due to heavier trains that can be handled, and the increased weight in motive power made possible by the new bridge shows an annual saving that eventually

with the use of falsework. This was particularly desirable owing to the danger from high water and ice during the early spring. The work of erection did not interfere with traffic of the road which would not have been the case should the old structure been remodeled. The Phoenix Bridge Co., of Phoenixville, Pa., had the contract for furnishing and erecting the steel work. Thirteen piers and 2 abutments were constructed of concrete according to plans herewith presented. The foundations were excavated by hand inside of clay puddled cofferdams, to the specified depth below the river bed. Oak piles were then driven for both piers and abutments with drop hammer and sawed off 2 feet above the bottom of each excavation. After this the foundation pumps were stopped and concrete distributed over the entire base by use of steel chutes. At times it was necessary to have

as many as four 8 inch centrifugal pumps operating at a time to keep excavation clear of water coming up through the bottom. A water jet was used at first in driving piles but it was found best to abandon the use of the jet on account of the material. The soil consisted largely of coarse gravel and sand. Gravel from the river was used throughout for concrete and was mixed in Ransome mixers. Concrete of the following proportions was used, piers including foundation, 1 : 2 : 4; abutment foundations 1 : 2 : 6; abutment neat work 1 : 2½ : 5 with the exception of the backwalls and coping, which were of 1 : 2 : 4.

The east abutment of the new bridge is faced against the north wing of the similar abutment of the old bridge as shown in an accompanying line engraving. The west abutment of the new structure contains about 2,000 cubic yards of concrete and is ribbed in the back as well as reinforced with ¾ inch steel rods spaced 9 inches from center to center.

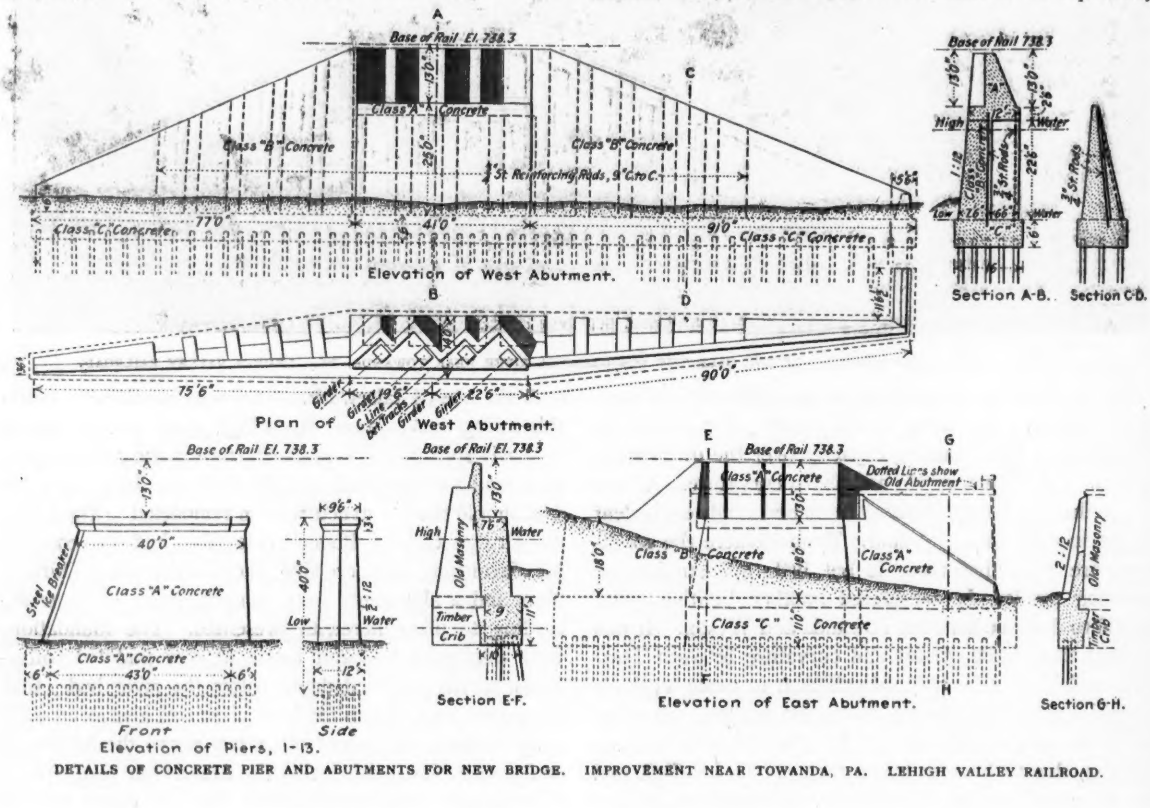
Work on the abutments was started on April 15, 1906 and on account of high water the piers were not started until July 9th, 1906. The concrete work was completed Oct. 29th, 1906. The time used in finishing the river work was exceptional, taking less than four months to complete 11 piers. This was accomplished by installing a large plant previous to time of low water season through the summer and just as soon as conditions permitted the work was started and rushed. The contractor's plant used in the construction of new piers is illustrated by line engraving, and consists of a 75 foot A frame tower that served as a center support for cableway, mounted



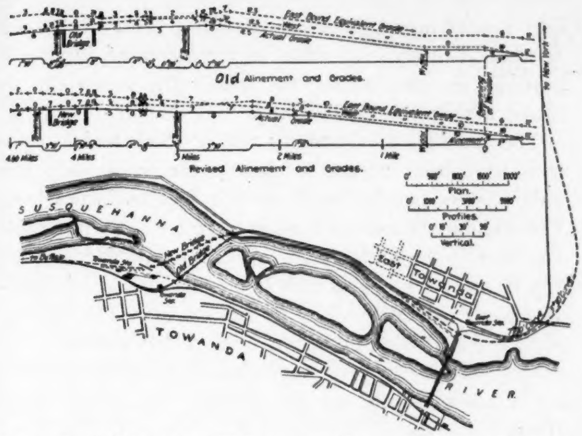
ARRANGEMENT OF CONTRACTOR'S PLANT. IMPROVEMENT NEAR TOWANDA, PA. LEHIGH VALLEY RAILROAD.

on pile bents of sufficient height to avoid any rise in the river. This tower was located about the center of the river and guyed from four sides. Double cableways were projected to each shore and was operated by a Lidgerwood plant. The cableway on each side of the A frame was about 1,000 feet span and supported on the shore ends by 80 foot towers containing the machinery. The double cableway was designed for a working load of 3 tons and was occasionally called upon to pick up machinery as heavy as 7 tons.

The piers are numbered consecutively beginning with number one on the east end to aid in making reference. A small cableway of 500 foot span was used to build the east abutment as well as piers 1 and 2. Derricks or whirlies, were used on piers 11, 12, 13 and the west abutment. The balance of the work was handled by the main cableway. This arrangement of cableway, and derricks allowed the work to be carried on separately



DETAILS OF CONCRETE PIER AND ABUTMENTS FOR NEW BRIDGE. IMPROVEMENT NEAR TOWANDA, PA. LEHIGH VALLEY RAILROAD.



OLD AND REVISED ALINEMENT AND GRADES. IMPROVEMENT NEAR TOWANDA, PA. LEHIGH VALLEY RAILROAD.

without interfering with one another. A track was built under the cableway on both shores to enable the removal of materials of construction directly from cars to the work and thereby save rehandling.

The work required six centrifugal pumps, three mixers and two pile-drivers to carry on the work at such a rapid rate, and the arrangement of this equipment may be seen in accompanying illustration. The main cableway handled all this machinery when it was necessary to make changes. Cableway construction proved itself to be suited for handling materials of this sort and has greatly reduced the time and labor required on this class of work.

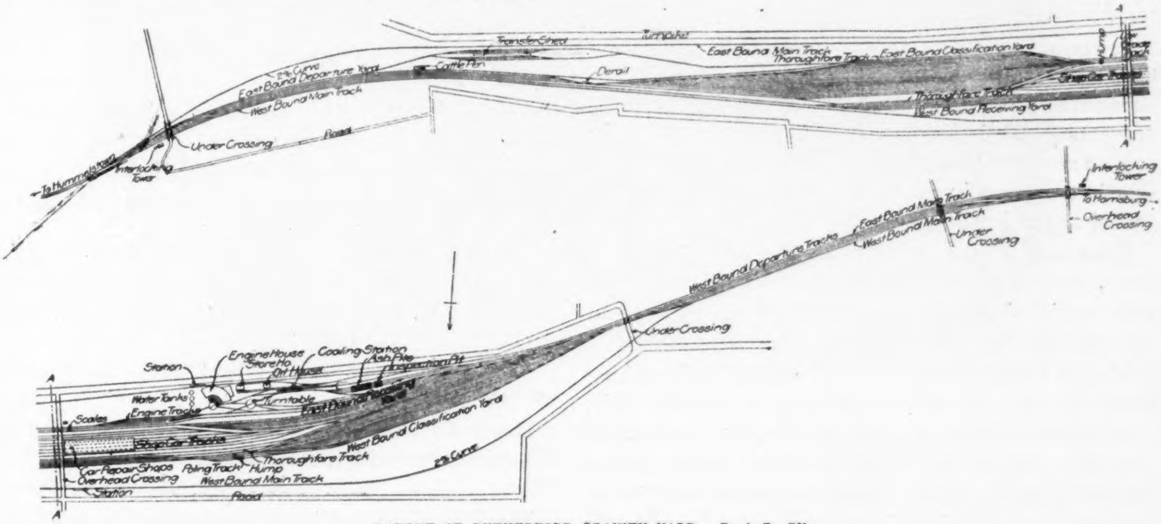
Special effort was taken to see that the A frame in the center of the river was well guyed so that the operation on one side would not interfere with that of the other.

We are indebted to Mr. Philip H. Dewitt, member American Society of Civil Engineers, Phillipsburg, N. J., for information and illustrations presented herewith.

Gravity Yard at Rutherford, Pa.

P. & R. Ry.

THE Philadelphia & Reading Railway Co. has recently made extensive improvements on their terminal facilities at Harrisburg, Pa., in the way of enlarging the yard at Rutherford, Pa., located about five miles east of Harrisburg, and which was started and partly finished in 1900 to relieve the congestion at Harrisburg. In 1904 it was decided to expand the Rutherford yard to accommodate the increase in traffic as well as to provide for keep passeger and freight traffic separate through this yard, the east and west bound main tracks were projected on each side of the yard, and acting as a boundary, within which was the entire freight yard. It seems the existing conditions, such as the location of the round house, turntable, coaling station ash pit, etc, was the cause of some of the construction used but was the best under circumstances.



LAYOUT OF RUTHERFORD GRAVITY YARD. P. & R. RY.

future increase. On account of the favorable typographical conditions, having a grade descending at the rate of .5 percent toward both Harrisburg and Reading, a gravity freight classification yard was decided upon. It was found necessary to provide for a much larger capacity for the east bound classification yard than for the west bound as was revealed from a study made of the traffic in the past and probable increase in the future. The greater number of empty west bound cars than east bound caused a difference in the design of humps. In order to

The distance of the yard from interlocker to interlocker is about 3 1-3 miles while the maximum width is about 900 feet. A convenient arrangement is having the east and west bound departure tracks entirely separate and away from classification yard. These departure tracks are located at the extreme east and west end of the yard, close to the caboose tracks, and where road engines have convenient access. The receiving yard is located conveniently to the classification yards also to car repair tracks, coaling station and round house.

The capacity of the east bound receiving tracks, containing 6 tracks, is 330 cars; the east bound classification yard, containing 23 tracks, holds 1,495 cars; the east bound departure yard, containing 3 tracks, holds 195 cars. The capacity of the west bound receiving yard, containing 5 tracks, is 375 cars, the west bound classification yard containing 13 tracks holds 650 cars; the west bound departure tracks, containing 3 tracks, hold 225 cars, the car repair yard, containing 8 tracks holds 472 cars making a total of 3,742 cars that yard is capable of storing. From 1,500 to 3,500 cars are classified daily over both humps and the work of classification is carried on efficiently.

Freight trains on entering the yard drop their caboose on tracks provided, at each end of the yard, for that purpose after which they proceed to the receiving yard. One track is always kept clear throughout the entire yard to provide for fast trains having perishable freight and live stock, and thus eliminate the necessity of having to go over the hump or through the classification yard. In taking trains from receiving yard to hump for classification yard, the switchman is furnished with a list of the various car numbers and their destination that enables him to classify cars in going over hump. Just a little before the cars reach the top of the hump to start on down grade, they are uncoupled and allowed to run by gravity to track assigned to destination which car is going. About 25 switchmen are employed to ride these cars. They are carried back to hump by a locomotive that runs back and forth on parallel track provided for this purpose.

Powerful locomotives are generally used for pushing long trains from receiving yards over the hump. The movement of trains over the hump is controlled by semaphore operated by hand and when these can not be seen on account of long trains or sharp curvature in track, signals are given by an electro pneumatic whistle controlled at the hump.

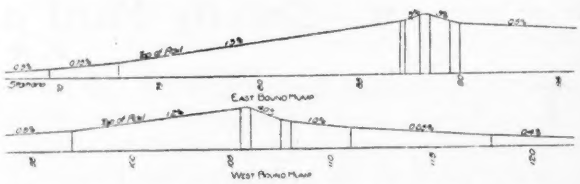
After train is made up in departure yard and ready to move, the road engine picks it up and proceeds out on the main track, where train is stopped or slowed up long enough at the head end of the yard to receive caboose.

The caboose tracks are on a 1½ percent grade, making it easy to start caboose to be attached to outgoing train.

It will be noticed that the east bound classification yard has 23 tracks with a capacity of 1495 cars as against 13 tracks with a capacity of 650 cars in the west bound classification yard. This is due to the east bound traffic being considerable heavier and requiring more classification. However the number of empty cars west bound are greater, causing longer trains and to meet this condition the west bound departure tracks are made considerable longer than corresponding tracks in east bound department yard. This condition of traffic has resulted in the difference in design of the humps. Empty cars can be hauled up steep grade easily and are slower in starting down grade than loaded cars. The west bound hump handling a large number of empty cars has 4 per cent for its initial grade as against 3 per cent for the east bound hump. To make up for increased friction in bearings on cars during the winter the hump can be raised from 10 to 15 inches.

The facilities for handling rolling stock and locomotives have been increased. A new car repair shop was built that is 123 feet wide by 602 feet 10 inches long. The coaling station has been enlarged, a new drop table was built in the round-house, a 75 foot turntable, and two 175 ft. ash pit was also added. A mechanical ash handling plant will be provided for the ash pit. The transfer shed is 24 ft. wide by 600 ft. long and is served by six tracks, three from each way. Track scales are installed on a track parallel to the leading east bound hump track.

All grade crossings intersecting this yard have been eliminated by either raising or depressing highway. A highway bridge has been constructed over the center of the yard as well as three subways projected under the



PROFILE OF HUMPS. RUTHERFORD GRAVITY YARD. P. & R. RY.

tracks. Two subways are built of concrete and reinforced with steel, one having a span of 20 ft. and carrying seven tracks, the other a span of 16 ft. and carrying six tracks. On the other subway the tracks are carried by a plate girder bridge with ballast decks.

As the Lebanon and Harrisburg turnpike was diverted from its original course to a north and easterly direction a subway was built at the east end of the yard for crossover. The combined road changing and subway required about 5,440 cubic yards of concrete and 23,130 square yards of stone macadam.

The bulk of material encountered in grading was a yellow loam clay and a small amount of limestone. About 600,000 cubic yards of materials were moved by steam shovels.

This improvement was designed under the direction of Mr. William Hunter, M. Am. Soc. C. E., chief engineer of P. & R. Ry., and to whom we are indebted for information herewith presented.

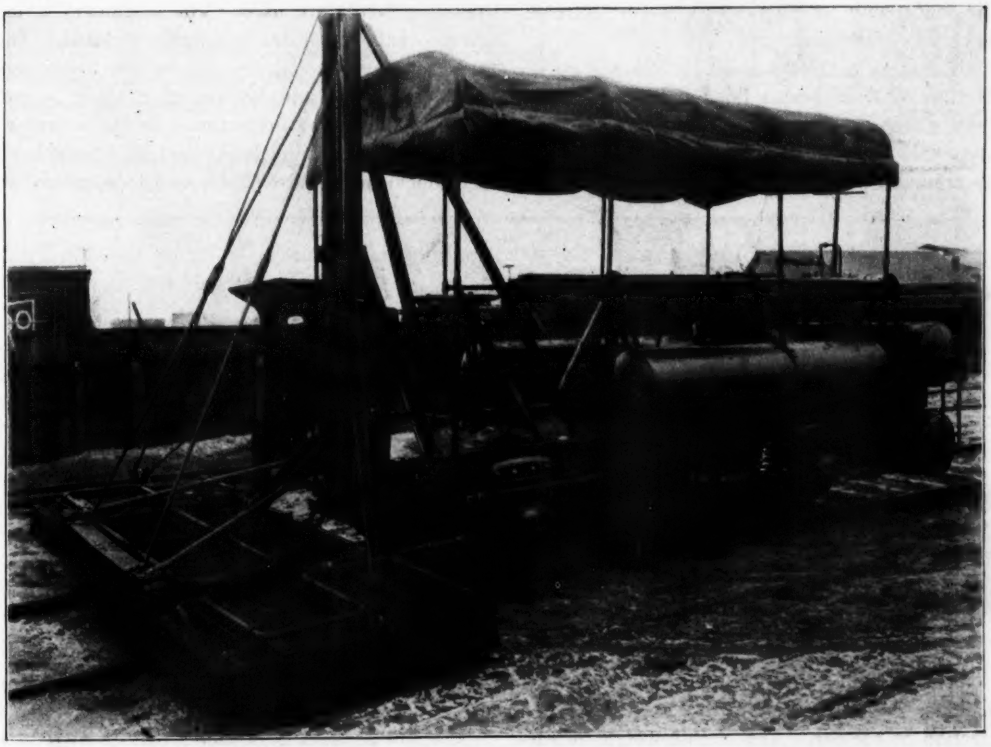
The Pennsylvania Railroad has built a modern freight terminal at Greenville, Jersey City, N. J., and such equipment has been installed that enable the handling of freight direct from car to ship and vice versa. There are two piers 2,000 feet long by 120 feet wide and are sufficient to handle all the freight that the lines can deliver. Float bridges operated by electricity are provided and are designed to carry 280 tons each. Their aprons can be raised or lowered by electricity while loaded with car. The complete yard will have a capacity for handling 78,000 cars monthly.

Gasoline Weed Burner

Union Pacific R. R.

THE Union Pacific has recently constructed at its Omaha Shop, under the supervision of Mr. W. R. McKeen, Jr., Superintendent of Motive Power & Machinery, a gasoline weed burner for the purpose of destroying the growth of weeds along the right-of-way, particularly on branches. As the branch lines generally rest on dirt ballast, the weeds grow up in the early spring and by fall in some cases they get from 7 to 8 feet high. This condition is anything but desirable, delays the movement of trains, causes slippery rails, thereby decreasing the efficiency of train service.

The officials of the Union Pacific Railroad seeing the necessity of some sort of mechanical weed destroyer set their engineers to work to try and solve this problem. One of the plans considered was to cut the weeds by machinery and then sprinkle the right of way with a solution of salt and water, hoping this would have a tendency to kill future growth. It was later suggested that a gasoline burner be tried and was later successfully developed.



GASOLINE WEED BURNER. UNION PACIFIC R. R.

The car is constructed entirely of steel, mounted on a four-wheel truck which is built in accordance with standard railroad practices. The propulsion of the car is effected by means of gasoline engine located at one end which also pumps air for distributing the gasoline in burners, and raising the side wings of the burner frame. The engine is equipped with variable speed gears, the low speed being geared from 3 to 4 miles per hour, and used when operating the burners, while the high speed gear, used in going to and from place of burning, enables the car to travel from 12 to 15 miles per hour. Several tanks are situated on the car which carry a small supply of oil sufficient for a day's run on the road. Compressed air is used to force the gasoline to a series of burners located on the rear of the car near the ground and while the frame mows the weeds, it does not entirely destroy the growth. The frame-work supporting the burners is divided into three sections, the center one being about 5 feet in width; the two remaining adjustable wings are attached to the center section and can be raised in order to clear cattle guards, obstructions, etc. This machine burns the weeds for a distance of 3½ feet each side of the rails. Twenty to twenty-five miles per day can be burned by this weed burner, running about three to four miles per hour. Three men are required for the operation of the car, it being run over the road under train orders the same as a work train.

In comparing the amount of work done by this machine with manual labor, it requires approximately 16 men to cut one mile of track per day, while at the rate above stated the machine does the equivalent work of about 300 men. The cost of destroying the weeds is $5.74 per mile as against $22.40 per mile when cut by hand.

The Copper River and Northwestern Railroad is building about 500 miles of new track from the tidewater terminal at Katalla, Alaska, through the Copper River Valley into the interior of Alaska. Contracts for this work in part is being let and is under the control of the Katalla Company, M. K. Rogers, President and General Manager, Seattle, Washington, and John Krey, Chief Engineer, Katalla, Alaska. This road is one of the J. P. Morgan and Guggenheim interests in Alaska.

Overhead Counterweight Railroad Bridge at Cleveland, O.

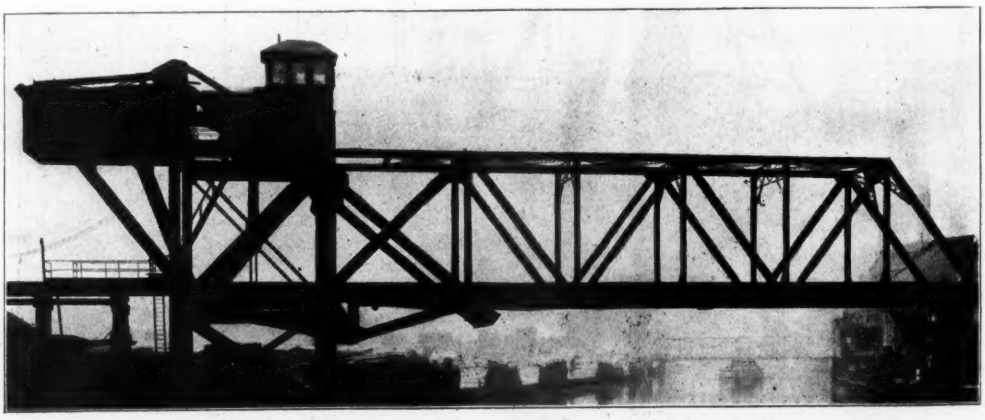
W. & L. E. R. R.

THE Wheeling & Lake Erie Railroad has recently installed a rolling lift bridge at Cleveland, Ohio, which is the second largest single leaf bascule span in the world. It is 150 ft. single leaf, single track span, across the Cuyahoga river, and gives a clear channel width of 120 feet at right angles to the stream. The bridge was designed under the Wabash R. R. Co's specifications, and for Cooper's E. 50 live load. Traffic was maintained throughout construction. The steel work was executed in the Toledo shops of the American Bridge Company. The contractor for the substructure was Mr. George Craig, of Toledo, O. Owing to labor troubles, the completion of the bridge was delayed about 3 months and it finally became necessary for the railroad company to finish the work with its own forces under extreme pressure and many difficulties.

The moving leaf is a riveted through Warren truss, with the bottom of floor beams flush with the bottom of the lower chord. Heavy laterals throughout and ample gussets and sway braces at all panel points, including the trunnions, make the leaf very rigid. The fixed portions is a double tower, supported on two independent piers, having a connecting apron or high water protection at the top. The counterweight is carried in a concrete box, having concrete walls 1 foot 11 inches thick and a concrete floor 2 feet 6 inches thick, supported on a structural steel frame, pin-connected to both the moving leaf and the tower. The counterweight itself is slag, weighing 180 lbs. per cu. ft. The total counterweight volume is 206 cu. yds., and the total weight 1,020,000 lbs. In cast iron this would have cost about $13,500.00, or about $10,000,00 more than the concrete and slag counter weight.

The outside trunnion bearings are carried directly on the main tower posts, while the inside bearings are supported on a box-shaped cross girder, riveted into the main tower posts. The form of the tail truss is such as to straddle this cross-girder, and to permit the bridge to open to an angle of 87 degrees. The towers are each 10 feet wide and are very stiff. The main trunnions are 20 inches in diameter, the counterweight pins 12 inches, and the link pins each 7 inches. The moving leaf, counterweight and counterweight link are all thoroughly braced, and the structure is absolutely rigid. No vibration is noticeable from live load or from the opening or closing of the bridge.

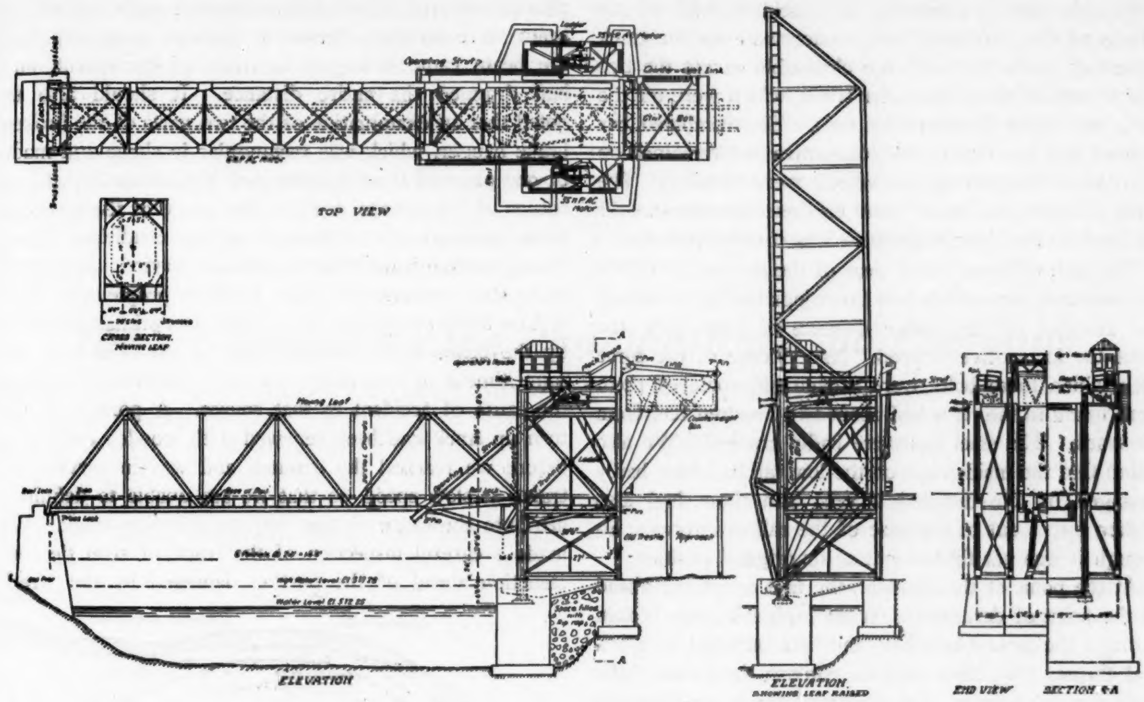
The power for operating the bridge is electric, two alternating current motors, each 35 H. P., being employed. It may be noted here that this is the first instruts, connected to a cross girder at the bottom. These cule bridge. Lifting is done by a pair of operating struts, conected to a cross girder at the bottom. These struts are independently counter-balanced, so that they are in equilibrium at all times and do not tend to unbalance the bridge proper, as is ordinarily the case where operating struts are used. The machinery is located at the top of the tower and is suitably enclosed. The operator's house is also at the top of the tower, and footwalks, stairways and ladders give ready access to all parts for oiling and inspection. In the operator's house are a mechanical hand brake and an emergency electromechanical brake; also motor and lock controllers, truss and lock indicators, switchboard and the various auxiliary devices.



OVERHEAD COUNTERWEIGHT RAILROAD BRIDGE AT CLEVELAND, OHIO.—CLOSED. W. & L. E R. R.

The locking devices include a pair of truss locks at the leaf end and a pair of rail latches at both floor breaks. The latches are of the ordinary sliding variety, while the former are retractile tongues fitted to the trusses and engaging with the truss shoes on the abutments. Locks and latches are operated simultaneously through the medium of shafting and gearing by a 3 H. P. motor located at the center of the leaf and controlled from the operator's house. From the nature of the bridge, its safety does not depend upon the lock and latches, and no accident is possible should trains cross while the truss and rails are unlatched.

It will be observed that there is not a single curved member in the entire structure, and that the outline throughout is of the simplest and most direct character. It will also be observed that the counterweight projects beyond and behind the supporting pin. This gives a pull in the link which is transmitted to the trunnion posts



PLAN AND ELEVATION OF OVERHEAD COUNTERWEIGHT RAILROAD BRIDGE AT CLEVELAND, OHIO. W. & L. E. R. R.

and equalizes the load on the piers, thus permitting an extremely economical substructure.

The regular time of opening is thirty seconds, but the bridge can be opened in twenty seconds. Balance is practically perfect, the leaf stopping at any point of its motion, when the current is shut off, without the use of the brakes. The motion is smooth, regular and noiseless.

Relative to the performance of the bridge, after a year's service, the only change which the test of actual use had shown to be desirable was in the keys of the counterweight link-pins. These developed a tendency to local movement, to provide for which the number of keys has been doubled and each key has been provided with a pair of keeper plates. Its power consumption is well within the maximum provided.

This bridge was installed under the supervision of Mr. A. O. Cunningham, Chief Engineer, Wabash R. R., St. Louis, Mo.

Report on the Derailment of the 18-Hour Train Near Mineral Point, Pa.

Pennsylvania Railroad

SHORTLY after the accident had by the 18-hour train between New York and Chicago on the Pennsylvania Railroad near Mineral Point, Pa., February 22nd, the officials of the railroad ordered an investigation to be made and report if possible the cause of derailment.

Especial effort was made by the investigating committee to make the report complete so that the interested public may have facts. The report consists largely of the mechanical facts and actions of the derailment, as there apparently is no negligence evident on the part of any employe. In going over the report made, it leads to believe the derailment was caused by a fallen brakebeam on the tender, derailing the rear truck wheels of the tender and the balance of the train.

The following report is made by a committee, consisting of Messrs. Herbert M. Carson, Assistant to the General Manager, A. C. Shand, Chief Engineer, and L. R. Zollinger, Engineer Maintenance of Way, all of the Pennsylvania Railroad, to Mr. W. W. Atterbury, General Manager:

Your committee appointed to investigate the cause of the accident to train No. 29 west of Mineral Point, on the Pittsburgh Division, on the night of February 22nd, arrived on the scene about four o'clock on the afternoon of the 23rd.

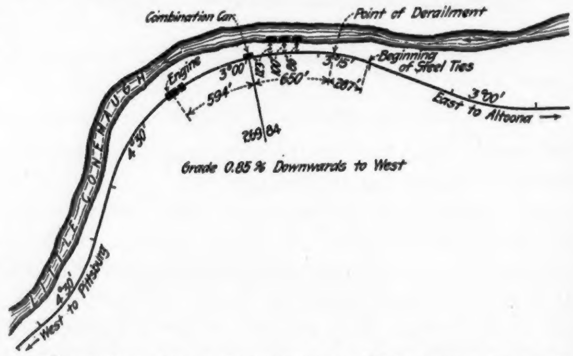
Previous to our arrival No. 3 track had been rebuilt for the entire stretch and was in service. The wreck occurred on the section of track laid with experimental Carnegie Steel Cross Ties, the first indication of derailment being a point 287 feet west of the east end of these ties, and on a three and a quarter degree curve to the left. The track had been torn up from this point a distance of 1,244 feet, where the locomotive stopped. The plan which accompanies this report indicates the position of the locomotive and cars as they were found immedi-

ately after the occurrence of the accident. All of the wheels of the locomotive and tender were on the track according to the best evidence obtainable except the two rear wheels of the rear tender truck, which were off the track and lying between the rails. The combined car stopped 594 feet east of the locomotive and remained on its trucks, although all the wheels were derailed. The three Pullman cars were found on their sides down over the bank in the river bed, which was covered with ice.

The high rail was found clear of the ties on top of the embankment, the outside bolt fastenings had been sheared and snapped off the entire distance of 1,244 feet, the point the locomotive stopped. As evidence of the force with which these bolts were broken off, some of them were found in the river bed about two hundred feet from the track. The steel ties were badly crushed. We also found that the inside clips on the low rail had been badly damaged by the derailed wheels, and these had also broken pieces out of the base of the rail at intervals, although it was not thrown out of its original position.

At the point of the accident, the first splice bar ahead of the point of derailment, on the high side, was broken through the second bolt hole and bent outward by a lateral thrust. We then went to Altoona, interviewed the engineer and fireman, and examined the locomotive and trucks in the engine house. The engineer's statement was that he had been making a good run down the western slope but at no place was running at an excessive speed; and before striking the stretch of steel ties he made an eight pound reduction of his air to steady the train, as was his custom. He states positively that before he applied his brake, he was not going more than fifty miles an hour, and record taken from the train sheet corroborates his statement. An instant after he applied the air, he felt the emergency go on, and, thinking it was a burst hose on the train, released his air and looked back, when he saw the cars going over the bank. He reapplied his brake and as soon as he stopped, got down to examine the locomotive; the fireman going ahead to flag the east bound track. He found the two rear wheels of the rear tender truck derailed and between the rails, and the brake beam down on the left side, pressing against the flange of the left rear wheel.

The brake shoe, half the brake hanger and the brake head had been lost from the left side of the brake beam. The beam was supported on the right or high side by its brake hanger and the shoe was in place. An examination of the locomotive in the engine house afterwards corroborated the engineer's statement, a piece of the brake hanger and part of the brake head having been subsequently found along the track, the brake head 500 feet and the half of the brake hanger 264 feet back of the point where the locomotive stopped. No part of the brake shoe has been recovered, although search was made for it. This is not surprising, however, considering the fact that the road bed was badly torn up for a distance of five or six hundred feet and had been replaced. We afterwards made an examination of the brake beam and found that the end on the left side had been caught under the flange of the wheel, as the mark made by the flange plainly indicated, although the abrasions of the end of the beam were hardly sufficient to indicate positively that the beam came down at the time of derailment, and had dragged the entire distance. It should also be noted that an examination of the two parts of the broken brake hanger, which was rectangular in shape and made of one piece of three-fourths inch iron, showed that one corner of it had been worn by the flange of the wheel at some previous time, although in this condition it was strong enough to withstand ordinary service. It seemed to be the impression of those Division people who were first on the ground, that the accident was primarily caused by the brake beam falling down on one side. At the same time it is impossible for us to definitely attribute the cause of accident to that source. A portion of the torn up track had been renewed with wooden cross ties, before we reached the ground, and was in service for trains at slow speed, so that we are unable to definitely attribute the cause in any way to defective track. We made a careful inspection of the track of steel tie construction ahead of the portion damaged by the wreck



PLAN SHOWING PLACE OF DERAILMENT OF 18-HOUR TRAIN NEAR MINERAL POINT, PA. PENNSYLVANIA RAILROAD.

and therefore not affected thereby, a distance of about half a mile, and found it in first class condition; all the outside clips being tight against the base of the rail, and the bolts on the inside, with few exceptions, being tight, holding the clips in position; the line and surface being as nearly perfect as it was possible to get track, and the whole mass of steel cross ties frozen tight to the ballast and not the slightest indication of shifting in any direction whatever, nor was there the slightest indication of movement on the top of the steel cross ties by any of the rails for the entire distance. If the accident had occurred on the section of the track laid with wooden ties, it is our judgment that less injury would have been done to the track structure, for after the one pair of wheels of the tender of the locomotive were derailed, the bolts of the outside of the high rail were snapped off throughout entire distance, the tender was derailed. The rail on this side having been shoved out and off the end of the cross ties.

A large portion of this rail was simply lifted back into position, and with new bolts and clips again placed in service, as there was little injury done to the steel cross ties west of the point where the combined car stopped.

We are unable definitely to account for the cause of

the accident, but the best reason for it that we can advance is, that at the point where the derailment occurred some foreign material became wedged between the flange of the left rear tender truck wheel and the inside or low rail, which, on account of the rigidity of the steel ties and fastenings, and on account of the low temperature, the temperature being twelve degrees below zero, produced sufficient lateral force to shear the bolts on the outside rail. It is possible that this foreign substance was the brake shoe or a part thereof, which, as before stated, has not been found. We are informed that the usual inspection was made of the locomotive before leaving the engine house, and the gauge of the wheels was measured in our presence after the accident and found to be correct.

We are of the opinion on account of the lack of positive evidence as to the cause of this derailment, and on account of the fact that the damage subsequent to the derailment was more serious than would have been the case with wooden ties, that the remaining steel ties should be removed.

Wharf Cranes for the Panama Railroad Company

THE Panama Railroad Company is making extensive improvements on their Pacific terminus wharves to transfer freight to and from vessels on cars.

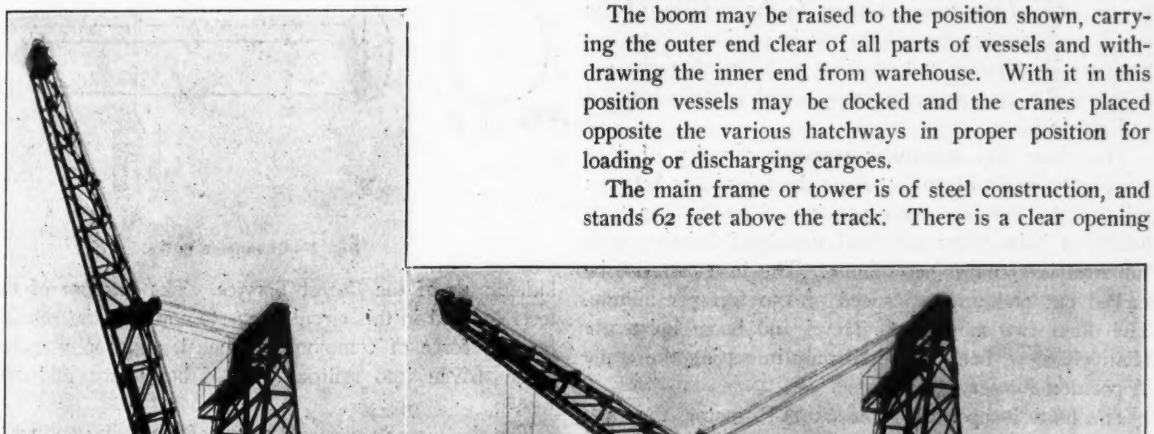
The accompanying illustrations show one of a lot of eight cranes now under construction by The Shaw Electric Crane Co., of Muskegon, Mich., as a part of this improvement. They are for use in handling miscellaneous freight at the Laboca wharf, which is the Pacific terminus of the railroad.

The cranes were designed to meet the peculiar conditions existing at the wharf, among which may be mentioned a tidal variation of about 20 feet.

The boom, which is 80 feet in length, is shown in accompanying illustration in its working position, standing at an angle a little over 30 degrees from horizontal. It is required that the outer end should stand at sufficient height to carry loads over the decks of the largest vessels at high tide, while the other end must be low enough to project inside of the warehouse door.

The boom may be raised to the position shown, carrying the outer end clear of all parts of vessels and withdrawing the inner end from warehouse. With it in this position vessels may be docked and the cranes placed opposite the various hatchways in proper position for loading or discharging cargoes.

The main frame or tower is of steel construction, and stands 62 feet above the track. There is a clear opening



WHARF CRANE FOR THE PANAMA RAILROAD CO.

through it 10 feet wide, in which the boom is suspended and through which the loads are carried.

The base is so constructed that the crane can travel over freight piled to a height of 6 feet between the tracks, and so that goods may be trucked directly from under the crane to the warehouse. The space between the front of warehouse and edge of wharf was sufficient for a track of only 11 feet gage. This, together with the necessary height and reach, made the question of stability a serious one. Although the weight of frame and machinery has been so disposed that the crane will be stable with a load 25% above normal capacity in the extreme position, clamps have been provided, which are always in engagement with the rear rail, to prevent the crane from tipping if a load should become fouled on a hatchway or other part of the vessel.

The crane is mounted on six wheels, four under the front and two under the rear. Anticipating the possibility of uneven settling of the wooden wharf, the wheels are carried in equalizers, so arranged as to compensate for any probable irregularities of track without straining the structure.

The machinery for the various movements is placed in the base of the tower, adding to the stability of the crane, and giving easy access for inspection. For convenience in shipping and erecting, each set of machinery is mounted upon a separate frame, which is easily handled and put in place.

The crane has a regular working capacity of four tons, and a reach of 40 feet from the center line between rails to the extreme outer position of load. The total height of hoist is 70 feet, and the speed hoisting with full load is 150 feet per minute. The load can also be racked out and up at a speed of 150 feet per minute. The other two movements, travel and boom hoist, are relatively slow, being required only in setting the crane in position for service.

The hoist is operated by a 65 H.P. motor, the rack motion by a 40 H.P. and the travel and boom hoist by 24 H.P. and 8 H.P. motors, respectively. Automatic switches are provided to prevent overtravel in hoisting and racking out, also an overload switch for the hoist machinery. All movements are under the control of one operator, whose cab is so located as to give him the best view of his work. The crane weighs nearly 50 tons, and with the boom in the raised position it stands 90 feet above the wharf. The motors and controllers, as well as all structural work and machinery are the product of The Shaw Electric Co.'s plant at Muskegon.

We are indebted to Manning, Maxwell & Moore, New York, for photographs and information herewith presented.

Culebra Cut excavation in May amounted to 690,365 cubic yards, while at Gatun 70,360 cubic yards was moved. The May total is less than for March and April, due partly to rainy weather and partly to the strike of steam shovel engineers.

Holding Force of Railroad Spikes in Wooden Ties

THE information herewith presented is a report made to the U. S. Department of Agriculture by W. Kendrick Hatt, Ph. D., Civil Engineer Forest Service, La Fayette, Ind., on the holding value of various railroad spikes in wooden ties.

Any increase in the practise of prolonging the life of ties by the use of preservatives, with the resulting economy of forest resources, depends largely upon the adoption of improved forms of spikes and fastenings. The use of the improved screw spike has been described in bulletin 50 of the Forest Service. The purpose of the tests covered in this circular was to compare the relative holding force of common, channeled, and screw spikes when driven into railroad ties of both hard and soft woods.

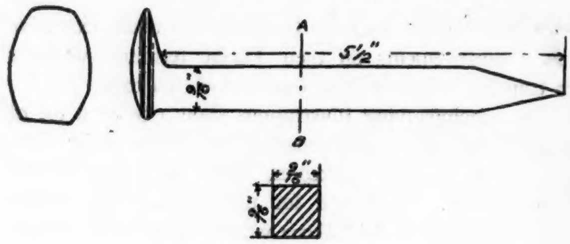


Fig. 1—Common Spike.

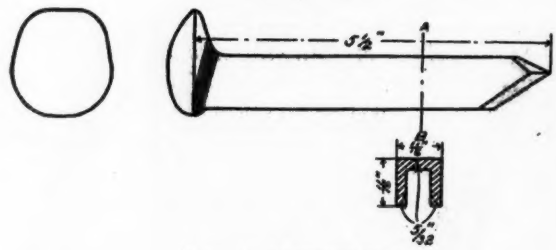


Fig. 3—Channeled Spike.

The ties were in different states of seasoning and some had been treated with preservatives. Spikes of the various forms were driven into the same tie. The results do not necessarily show in general the relative capacity of various species to hold spikes. They compare the action of the spikes.

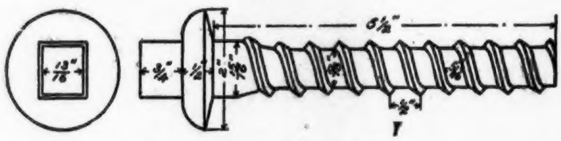


Fig. 2—Common Screw Spike.

Fig. 4—Illinois Central Screw Spike.

The spikes used, the dimensions of which are shown in the acompanying diagrams, were—

(1) Common spikes, weight 165 spikes to 100 pounds. (See Fig. 1.)

(2) Common screw spikes, similar to those in use on the French and other continental railroads, weight 85 spikes to 100 pounds. (See Fig. 2.)

(3) Channeled spikes, weight 200 spikes to 100 pounds. These spikes are of about the same form as the common spikes, with the addition of a channel cut lengthwise in the side away from the rail. (See Fig. 3.)

(4) Illinois Central screw spikes, weight 85 spikes to 100 pounds. (See Fig. 4.)

The only apparent difference between the two forms of screw spikes is in the manner of finishing the thread under the head.

METHOD OF TESTING.

The common and channeled spikes were driven into the tie in the usual way to a depth of 5 inches. For the screw spikes a hole was first bored of the same diameter as the spike at the base of the thread, and the spike was then screwed down to the same depth as the driven spikes. No spike was used a second time. A special steel claw was constructed for gripping the spikes and pulling them from the tie in the direction of their length. The tie containing the spike was placed on top of the fixed head of a testing machine, so that the head of the spike extended into the opening in the center of the head of the machine. The pulling device was then slipped under the spike head and its shank attached to the movable head of the machine. The descent of the movable head drew out the spike.

TABLE 1.—*Holding force of common and screw spikes.*

Species of wood and kind of spike.	Number of tests.	Condition of wood.	Force required to pull spike. Average.	Maximum.	Minimum.
			Pounds.	*Pounds.*	*Pounds.*
White oak:					
Common spike	5	Partially seasoned	6,950	7,870	6,160
Screw spike	5	....do	13,026	14,940	11,050
Ratio			1.88		
Oak (probably red):					
Common spike	5	Seasoned	4,342	5,300	3,490
Screw spike	8	....do	11,240	13,530	8,900
Ratio			2.61		
Loblolly pine:					
Common spike	28	Seasoned	3,670	6,000	2,320
Screw spike	26	....do	7,748	14,680	4,170
Ratio			2.11		
Hardy catalpa:					
Common spike	12	Green	3,224	4,000	2,190
Screw spike	14	....do	8,261	9,440	6,280
Ratio			2.56		
Common catalpa:					
Common spike	11	Green	2,887	4,500	2,240
Screw spike	11	....do	6,939	8,340	5,890
Ratio			2.42		
Chestnut:					
Common spike	4	Seasoned	2,990	3,220	2,000
Screw spike	5	....do	9,418	11,150	7,470
Ratio			3.15		

TABLE 2.—*Holding force of channeled, screw, and common spikes.*

SOAKED LOBLOLLY PINE TIES (NATURAL AND STEAMED).

Kind of spike.	Number of tests.	Force required to pull spike. Average.	Maximum.	Minimum.
		Pounds.	*Pounds.*	*Pounds.*
Channeled	46	4,010	6,640	2,530
Screw	46	6,585	12,070	3,080
Common	44	3,570	5,450	2,450

TABLE 3.—*Holding force of Illinois Central screw spikes, common screw spikes, and common spikes.*

SEASONED LOBLOLLY PINE TIES (NATURAL AND STEAMED).

Kind of spike.	Number of tests.	Force required to pull spike. Average.	Maximum.	Minimum.
		Pounds.	*Pounds.*	*Pounds.*
Illinois Central screw	20	7,089	9,600	5,000
Common screw	16	6,945	9,740	4,170
Common	14	3,494	6,000	2,320

TABLE 4.—*Holding force of screw, common, and channeled spikes.*

TIES SEASONED AND SOAKED.

Seasoning condition.	Force required to pull spike. Screw. Number of tests.	Screw. Pounds.	Common. Number of tests.	Common. Pounds.	Channeled. Number of tests.	Channeled. Pounds.
Seasoned [a]	26	7,748	16	3,398		
Seasoned [b]	16	6,945	14	3,494		
Soaked [b]	46	6,585	44	3,570	46	4,010

[a] Natural wood. [b] Natural and steamed ties.

TABLE 5.—*Holding force of common and screw spikes.*

SEASONED CLEAR AND KNOTTY LOBLOLLY PINE TIES.

Position of spike.	Kind of spike.	Number of tests.	Force required to pull spike. Average.	Maximum.	Minimum.
			Pounds.	*Pounds.*	*Pounds.*
In clear wood	Common	38	3,466	6,230	1,880
In knotty wood	....do	18	2,615	3,750	1,010
In clear wood	Screw	40	7,180	13,710	2,600
In knotty wood	....do	20	9,763	17,200	4,890

TABLE 6.—*Effect of cylinder operations on the holding power of loblolly pine for screw spikes and common spikes.*

SEASONED TIES.

Treatment.	Screw spike. Number of tests.	Screw spike. Force required to pull spike.	Common spike. Number of tests.	Common spike. Force required to pull spike.
		Pounds.		*Pounds.*
Steam 4 hours at 10 pounds	32	9,185	32	3,963
Steam 4 hours at 20 pounds	32	8,028	32	3,942
Steam 4 hours at 30 pounds	32	7,753	32	3,471
Steam 4 hours at 40 pounds	31	7,209	32	2,803
Steam 4 hours at 50 pounds	30	6,234	30	2,528
Steam 2 hours at 20 pounds	32	7,584	32	3,369
Steam 6 hours at 20 pounds	30	6,435	30	2,942
Steam 10 hours at 20 pounds	32	6,513	32	2,763
Steamed and creosoted	30	5,281	18	2,448
Steamed and zinc chlorid	26	5,838	20	2,657
Natural	26	7,748	16	3,398

RESULTS OF TESTS.

The results of the tests are shown in Tables 1 to 6.

Table 1 compares the efficiency of the common and screw spikes and shows that the latter resist withdrawing with from two to three times the force of the former. The advantage of the screw spike becomes more marked in the softer woods.

Table 2 shows that in soaked loblolly pine the channeled spikes have about 60 per cent of the holding power of screw spikes, and about 12 per cent more holding power than common spikes. Because of the channel in the channeled spikes they distort the wood fiber less than do the common kind.

Table 3 shows that in loblolly pine the Illinois Central spikes and the ordinary screw spikes have practically the same holding power, as would be expected from their similarity in form. The force required to pull them is about double that required for common spikes.

Table 4 shows that seasoned ties have a greater holding power than steamed ties.

Table 5 shows that a knotty tie has about 25 per cent less holding power for common spikes than a clear tie, while with screw spikes the conditions are reversed, since a knotty tie has 35 per cent greater holding power for these spikes than a clear one.

Table 6 shows that the holding power of a natural tie and of one steamed for four hours at 30 pounds pressure is about the same. Steaming for four hours at less than 30 pounds appears to increase the holding power, while steaming for more than four hours at 20 pounds decreases it. Ties steamed and creosoted or steamed and treated with zinc chlorid appear to have less holding power than those simply steamed.

Communications

Editor Railway Engineering:

In discussing the subject of editorial on Painting Bridges in Winter, in your April issue it is commonly agreed that the question of temperature does not cut so much figure as the condition of the structure with reference to moisture. If bridges are thoroughly cleaned before painted, and the bridge members are dry when paint is applied, we think that just as good results are obtained in moderate winter weather as in average summer weather. We do not think that the best results are obtained either in excessively hot weather or in zero weather.

Yours truly,

W. B. Causey,
Engineering Maintenance of Way,
Chicago & Alton R. R.

Bloomington, Ills.

Editor Railway Engineering:

Noting your editorial in the March issue on Painting Steel Bridges in Winter as well as comments made by Friend Pitard in your May issue, I wish to heartily endorse all that he has said on the subject. However, I would like to add my personal judgment hoping this discussion may result in some necessary improvements being inaugurated.

The word winter in this northern latitude implies a cold, inclement, unsettled, rainy or snowy season when an occasional day only may be had in which work of this kind might be commenced but not likely finished.

Durability being the essential, the substance of this question is the proper time and method of applying a suitable coating to steel bridges.

Experience and the most eminent chemical authorities tell us the first and most important requisite after all rust is removed, regardless of what color is used, is a dry, warm atmosphere. This being true why think of doing this work in the northern states or Canada, when the atmosphere during the winter season, with rare exceptions is very moist and as a rule the temperature considerably below fifty degrees.

The many rust covered bridges we see is sufficient evidence I think, either that the work is done indifferently or that the destructive influences to which paint on metal is subjected are not understood.

Rust once formed, unless thoroughly removed, carries within itself the elements of a ceaseless life or in other words rust begets rust continuously and any coating over it simply serves as a short lived mask. At all times the horizontal parts are those subjected to the most wear and destructive elements and should demand more attention as no calculation of the durability of the color on these parts can be correctly determined.

Sufficient help can and should be obtained to do this work, in the dry summer months, and as this is the slack time in most car shops arrangements might be made to transfer the willing workman along the line as required to aid in completing this work in the proper season.

With the traffic trebled in the last ten years the service has multiplied and the destruction through the wear also trebled.

It naturally follows that the attention should proportionately be increased.

If economy is the watchword in the maintenance of all railway equipment, eternal vigilence must be the price as far as the steel bridge is concerned, and the old saying "What is worth doing is worth doing well" ought to be rigidly adhered to in the maintenance of these structures.

In conclusion let me say briefly to those interested, considering the requisites, the time, cost and satisfaction of being able to do this work, not only much better but with more comfort I would say, "Don't paint your steel bridges in winter."

T. J. Hutchinson,
Grand Trunk Ry. System.

London, Ontario, Canada, June 3, 1907.

Editor Railway Engineering:

In your May issue I notice an article on switch points, recommending points 16½ ft. long instead of the customary 15 ft. points as practically all rails nowadays are rolled 33 ft. long the making of 15 ft. switch points would entail a waste of 3 ft. of rail while the 16½ ft. point would prevent such waste. I think we might go a step further and say that a No. 5, 6 and 7 frog turn out will not require as long a switch point as a No. 12 or No. 15 turn out; hence, it might be a good idea to make some switch points 11 ft. long and make others 22 feet long; this would give three different lengths of switch points namely 11 ft. 16½ ft. and 22 feet; the 11 ft. points to be used on turn outs of No. 4, 5, 6 and 7 frogs; the 16½ ft. point could be used in turn outs of No. 8, 9, and 10 frogs and the 22 ft. point in turn outs of Nos. 11, 12, and 15 frogs. This would help to make the approach to the higher number of frogs, which are usually put in in cross overs between main tracks or passing sidings, easier, so that trains could pass through such a switch at a greater speed than is ordinarily possible with the 15 ft. point.

The writer thinks there is lots of room for improvement in our present methods of switch construction; the idea of having a 15 ft. switch point for a turn out of a No. 12 frog has always seemed wrong to me, because the turn out curve for a No. 12 frog is less than 4¼ degree, while the 15 ft. switch point forms an approach of about a 13 degree curve. I think the best arrangement would be one giving a uniform curve from point of switch to point of frog.

F. R.

Editor Railway Engineering:

Noting comments made on editorial on Painting Steel Bridges in Winter, by Friend Pitard in a current number of Railway Engineering, I will give you my views and practice in an humble way, and have found them very successful in the past thirty years that I have had supervision of this work.

We will assume that it is well understood that to paint a steel bridge properly, so as to secure the best results,

during the winter months, entails a greater cost in the expenditure of time and requires more care and watching.

There are times during winter when owing to sleet, snow and rain, it is an utter impossibility, unless there is some provision made to cover structure, or portions from the elements.

For this reason, unless for some sufficient cause, such as its erection having just been completed, and the steel in such condition, that it is a necessity to protect it from rust, it should not be attempted.

But in case an emergency exists so that such a course is imperative, we proceed as follows: Thoroughly clean off all rust, dirt, cinders, coal, bird's nests, etc. If the day is favorable and not too much moisture in air to injure the paint, we apply the first coat as rapidly as surface is cleaned. This to be a heavy body and well rubbed out.

If there are indications of frost for the night, or a heavy chilling dew, we avoid as much as possible, applying paint to top chords, or any surface easily reached by frost, except early in the day when there is an opportunity for paint to set well before night.

Otherwise the frost would injure the surface causing it to become porous, which is the thing above all others that we wish to avoid. It is a well known fact that oil entering into the composition of the paint when touched by dew or frost before it is set, takes up a certain per cent of moisture and invariably gives bad results.

Another thing that we give special attention to is places where cinders, coal, etc., collect, also where the sun and air do not easily reach.

These places we clean well and freeing them from rust scale and ice if any, and give them a chance to dry in the early stages of painting.

When they are perfectly dry we lose no time in getting a coat of paint on them. After we have applied the first coat the work is more rapid as the surface dries free from moisture more rapidly.

When the first coat is dry and free from moisture, the second is applied.

As to pigments used I will state that we use nothing but boiled linseed oil and red lead, with the addition of ten lbs. of lamp black to 100 lbs. red lead for the second coat.

As to tools for applying paint we use a 3 in. flat painter's wall brush and sheepskin swabs for painting inside of cords. I am sorry to say that we use no sand blast on bridges, but do on all steel work at shops that require painting. Yours truly,

A. J. Bruning, L. & N. Ry.

Evansville, Ind.

Prices on Track Materials F. O. B. Chicago

TRACK SUPPLIES.

Steel Rail, 60 lbs and over	$28.00 per gross ton
Steel Rail, 30 to 45 lbs	35.00 per gross ton
Steel Rail, 25 lbs.	36.00 per gross ton
Steel Rail, 20 lbs.	37.00 per gross ton
Steel Rail, 16 lbs.	38.00 per gross ton
Steel Rail, 12 lbs.	39.00 per gross ton
Ties, 6x8x8 oak, 1st grade	.75 to 77c each
Ties, 6x8x8 oak, 2d grade	.65c cash
Switch Ties	$30.00 M. ft.

Angle bars, accompanying rail orders, 1907 delivery, 1.65c.; car lots, 1.90c. to 1.95c.; spikes, 2.35 to 2.45c., according to delivery; track bolts, 2.65c. to 2.75c., base, square nuts, and 2.80c., to 2.90c., base, hexagon nuts. The store prices on track supplies range from 0.15c. to 0.20c. above mill prices. Switch set per turn out, $175 to $200.

OLD MATERIAL.

	Per Gr. Ton.
Old Steel Rails, 3 ft. and over	$19.25 to $19.75
Old Steel Rails, less than 3 ft.	18.50 to 19.50
Old Iron Rails	24.50 to 25.00

SHEET STEEL.

It is quoted for future delivery:

Tank Plate, ¼-in. and heavier, wider than 6¼ and up to 100 in. wide, inclusive, car lots, Chicago, 1.88c., to 2.08c.; 3-16 in., 1.98c. to 2.18c.; Nos. 7 and 8 gauge, 2.03c to 2.23c.; No. 9, 2.13c. to 2.33c. Flange quality, in widths up to 100 in., 1.98c. to 2.08c., base, for ¼-in. and heavier, with the same advance for lighter weights; Sketch Plates, Tank quality, 1.98c to 2.18c; Flange quality, 2.08c. Store prices on Plates are as follows: Tank Plate, ¼-in. and heavier, up to 72 in. wide, 2.20c. to 2.30c; from 72 to 96 in. wide, 2.30c. to 2.40c; 3-16 in., up to 60 in., wide, 2.30c. to 2.40c.; 72 in. wide, 2.50c. to 2.65c.; No. 8 up to 60 in. wide, 2.35c to 2.45c.; Flange and Head quality, 0.25c. extra.

STRUCTURAL STEEL SHAPES.

Store quotations are unchanged at 2.05c. to 2.10c., and mill prices are as follows: Beams and Channels, 3 to 15-in., inclusive, 1.88c.; Angles, 3 to 6-in., ¼-in. and heavier, 1.88c.; larger than 6-in. on one or both legs, 1.98c.; Beams, larger than 15-in, 1.98c.; Zees, 3-in. and over, 1.88c.; Tees, 3-in. and over, 1.93c., in addition to the usual extras for cutting to extra lengths, punching, coping, bending and other shop work.

CAST IRON PIPE.

Quotations per net ton on Water Pipe, 4-in., $38 to $39; 6 to 12-in., $37 to $38; over 16-in., $36 to $37; with $1 per ton extra for gas pipe.

CEMENT.

	Package.
	$1.95 in wood
Good grade Portland Cement, car lots	$1.55 in paper
	*1.95 in duck

*(Duck sacks credited when returned.)

SAND

Bank sand, car lot	$ .75 per yd.
Torpedo sand, car lot	1.20 per yd.

CRUSHED STONE AND GRAVEL.

Crushed limestone, car lot	$1.10 per yd.
Crushed gravel, car lot	1.00 per yd.

Personals

Mr. E. L. Pollock, heretofore purchasing agent of the New York, New Haven & Hartford, has been appointed vice-president of the Rock Island system, in charge of purchases and stores, with office at Chicago, Ill.

Mr. W. A. Allison has been appointed superintendent of telegraph of the Trinity & Brazos Valley, with office at Teague, Tex.

Mr. J. J. Flynn has been appointed superintendent of the Trinity & Brazos Valley with office at Teague, Tex. Mr. Flynn has heretofore been superintendent of the Yazoo & Brazos Valley, and has been succeeded in the latter position by Mr. J. F. Porterfield, with office at Memphis, Tenn.

Mr. W. H. Collins, heretofore master mechanic, has been appointed general superintendent of the Fonda, Johnstown & Gloversville, with office at Gloversville, N. Y., to succeed Mr. J. N. Shannahan resigned.

Mr. C. H. Scott has been appointed superintendent of the Ft. Worth, Dallas, Denton and Henrietta divisions, and the Sherman, Bonham and Cleburne branches of the Missouri, Kansas & Texas, with office at Denison, Tex., to succeed Mr. R. J. Sullivan, resigned. Mr. E. F. Stahl has been appointed acting superintendent of the Shreveport and Mineola divisions and the McKinney branch, with headquarters at Greenville Tex., in place of Mr. Scott.

Mr. T. E. Hill, heretofore roadmaster of the Louisiana division of the Illinois Central, has been appointed superintendent of the Louisiana division, with office at McComb, Miss., succeeding Mr. J. F. Porterfield, Mr. T. L. Dubbs, heretofore trainmaster at Fulton, Ky., has been appointed superintendent of the Nashville division, with headquarters at Nashville, Tenn., in place of Mr. H. J. Scheuing, resigned.

Mr. W. A. Christian has been appointed assistant engineer of the Chicago Great Western at St. Paul, Minn.

Mr. J. E. Mellen has been appointed roadmaster of the National of Mexico at Monterey, Mex., in place of Mr. George Budge, resigned.

Mr. M. C. Hamilton has been appointed engineer maintenance of way of the New York, New Haven & Hartford at New Haven, Conn., to succeed Mr. W. J. Black, transferred.

Mr. N. P. Anderson has been appointed roadmaster of the Missouri & North Arkansas at Seligman, Ark. Mr. William Bennett has been appointed roadmaster at East Harrison, Ark.

Mr. W. S. Bouton, heretofore chief bridge draftsman of the Baltimore & Ohio, has been appointed assistant engineer of bridges and buildings, with office at Baltimore, Md., succeeding Mr. William Graham, resigned. Mr. W. R. Edwards succeeds Mr. Bouton.

Mr. T. A. Winborn has been appointed road supervisor of the Louisiana division of the Illinois Central with office at McComb, Miss., in place of Mr. C. F. Sherman, who has been appointed roadmaster with office at McComb, succeeding Mr. T. E. Hill, promoted.

Mr. E. J. Bouchard has been appointed superintendent of the Sierra Railway of California, with office at Jamestown, Cal.

Mr. D. C. Coleman has been appointed superintendent of the third district of the Canadian Pacific, with headquarters at Nelson, B. C., succeeding Mr. J. S. Lawrence, transferred.

Mr. David W. Ross has resigned as general purchasing officer of the isthmian canal commission, to engage in other business.

Mr. W. E. Brooks has been appointed superintendent of the Missouri Pacific with office at Atchison, Kan., to succeed Mr. J. M. Walsh, who has been transferred to the superintendency of the central division, with headquarters at Van Buren, Ark,, succeeding Mr. J. W. Dean. Mr. A. J. Alexander, superintendent of the Arkansas division, has been appointed superintendent of the eastern division, with headquarters at Sedalia, Mo., in place of Mr. H. G. Clark, promoted. Mr. J. W. Dean has been appointed superintendent of the Missouri division, with office at De Soto, Mo., to succeed Mr. J. Cannon, who has been transferred to Little Rock, Ark., as superintendent of the Arkansas division, in place of Mr. A. J. Alexander.

Mr. A. E. Mitchell, in addition to his duties as expert and engineer of tests of the New York, New Haven & Hartford, has been appointed manager of purchases and supplies of that road and the Central New England, with office at New Haven, Conn., succeeding Mr. E. L. Pollock, whose title was purchasing agent.

Mr. C. G. Walker has been appointed superintendent of the Louisville division of the St. Louis-Louisville lines of the Southern Railway, with headquarters at Louisville, Ky., succeeding Mr. B. C. Milner, resigned. Mr. J. F. Sheridan, heretofore assistant superintendent of the St. Louis division of the St. Louis-Louisville lines, has been appointed superintendent of terminals at East St. Louis, Ill., and the former office has been abolished.

Mr. A. M. Acheson has been appointed superintendent of the Trinity division, Missouri, Kansas & Texas, vice Mr. R. C. Hammond, assigned to other duties.

Mr. H. J. Scheuing, superintendent of the Illinois Central, at Nashville, Tenn., has resigned and has been succeeded by Mr. T. L. Dubbs.

Mr. J. E. Carver has been appointed superintendent of the new Fargo division of the Northern Pacific, including that part of the main line and the branches between Fargo and Jamestown, N. D.

Mr. W. J. Helmick has been appointed superintendent of the Brookhaven & Pearl River, with headquarters at Brookhaven, Miss., to succeed Mr. Alfred Mead.

Mr. C. L. Bardo has been appointed superintendent of the electric division of the New York Central & Hudson River and the Grand Central station. Previously he was assistant superintendent of the New York, New Haven & Hartford, in charge of the Mott Haven freight terminal

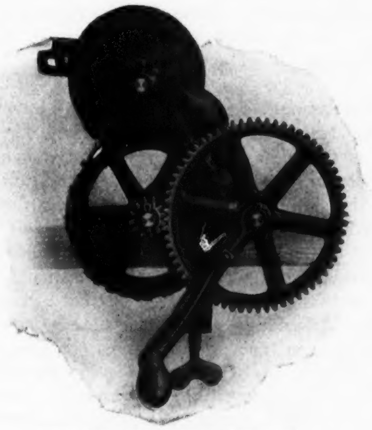
Mr. C. M. Levey, third vice-president of the Northern Pacific, announces that, effective on June 15, the company's lines will be operated in two grand divisions as the lines east and the lines west of Trout Creek, Mont. Mr.

H. J. Horn, with headquarters in St. Paul, will be general manager in charge of maintenance and operation of lines east. Mr. H. C. Nutt, with headquarters at Tacoma, will be general manager in charge of maintenance and operation of lines west.

A number of changes have been made on the Mexican International. Mr. W. F. Sheridan, previously superintendent of transportation, is made general superintendent. Mr. R. L. Schmalhausen has been appointed superintendent of the northern division. Mr. M. A. Needham, has been made superintendent of the southern division at Torreon, Mex.

Buda Portable Drill Grinder

The Buda Foundry & Manufacturing Company of Chicago has marketed an efficient portable tool grinder especially adapted for railroad work. This grinder is illustrated herewith and is complete with three interchangeable carborundum wheels for fine, medium, and coarse work, together with gearing that makes it possible to attain 3,500 R. P. M. of grinder by hand power. High speed is desirable as it insures long life to the carborundum wheel and assists in rapid cutting. A Locke oil tempered steel chain is used and provisions made for taking up the slack. All bearings are exceptionally wide, and well protected from dust. To obtain best results with carborundum grinders, a high speed should be obtained and then the lightest touch of the metal on the grinding wheel will properly perform the work. Slow speed and heavy pressure is injurious to both wheel and metal. The principle involved in the use of carborundum is that of cutting the metal and not grinding. As the work is done with little friction excessive heating is avoided. It is claimed



BUDA PORTABLE DRILL GRINDER.

by the manufacturers that this grinder will do the work of twenty men using ordinary sand grind-stones. An adjustable malleable iron clamp is provided to enable fastening grinder to the hand car platform or any convenient bench or timber. A removable bracket is provided with grinder that enables the grinding of twist drills. By swinging bracket back and forth all parts to be sharpened on the drill comes in contact with grinding wheel. These grinders are made in two styles known as Nos. 1 and 2. Style No. 2 is illustrated herewith and is a trifle smaller than No. 1. They are of similar construction and successfully serve the purposes intended.

General Fire Proofing Company Changes

The General Fireproofing Company of Youngstown, Ohio, has made several changes among their representatives as well as increasing their plant to provide for increased business. A branch office has been established at 82 Second Street, San Francisco, with Mr. N. N. Thurston as District Manager. Mr. W. E. Ramsey, formerly engineer with The Expanded Metal Fireproofing Co., of Chicago, has accepted a position with this firm at their home office at Youngstown. Mr. Jesse Briegel has been engaged as salesman at the Chicago office.

This company has made several additions to their plant at Youngstown, Ohio, practically doubling the capacity of the Allsteel furniture factory as well as erecting some new machinery in the Lug Bar and Girder Frame Departments.

The office building has been enlarged to accommodate the Reinforced Concrete Department, by the erection of a two story building 36x73 feet and connected with the former office by a wing 36x36 feet. Cement plaster applied over Herringbone Expanded Steel Lath is used for the exterior finish and instead of wood work on the addition, allsteel base boards, mouldings, window and door casings and doors, finished like Mahogany, have been used.

Electro-Pneumatic Signals

AND THE PROPER LUBRICANT FOR THEM.

The following letter comes to us from the supervisor of signals of one of the large Eastern trunk lines and shows how satisfactory Dixon's Air Brake and Triple Valve Grease is for lubricating the delicate parts of the electro-pneumatic signal system. We do not know whether or not the supervisor would be willing for us to use his name for publication, but do not feel at liberty to do so at this writing.

Joseph Dixon Crucible Company,
Jersey City, N. J.

Dear Sirs:—We have been using Dixon's Air Brake and Triple Valve Grease for the lubrication of buffer cylinders of motor signals, and thus far it has been entirely satisfactory. We have not as yet had any experience with it in cold weather, but believe it will be all right. We are now trying it in air cylinders of electro-pneumatic signals. We have nothing to do with the operation of air compressors, and therefore have not tried the grease in cylinders as you suggest. After we have had a little more experience with the grease, I will be very glad to inform you of results, and would have no objection to your calling attention of other supervisors of signals to the fact.

Yours truly,
Supervisor of Signals.

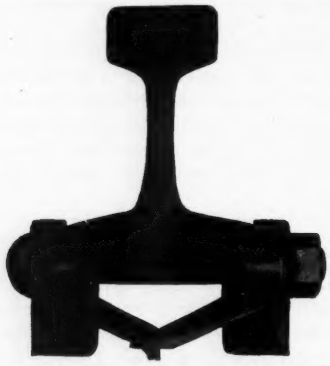
Courtesy Graphite.

Paine's Vise-Grip Rail Anti-Creeper

Since the advent of double track lines on Railroads, the creeping of rails has been a problem of serious consideration. The trains all moving in the same direction on the rail, give a continual and powerful pressure on the rails, causing them to creep; thus endangering the permanency of the road-bed with corresponding liability to accidents. Recognition of the necessity of a permanent and secure fastening of the rails against this tendency has resulted in several devices designed for this purpose. These consist usually of a small hook casting on each side of the rail base with a connecting bolt from one to the other underneath the rail, the whole resting against the tie. The tightening of the bolt is supposed to put sufficient grip on the rail base to hold the rail from slipping, but as the bolt runs under the rail base and the hook is above, a tightening of the bolt to any extreme pressure invariably results in a downward draw of the hook castings at the sides instead of the closing clamp required to hold it. This usually prevents any real and permanent grip sufficient to hold the rail and results in inefficiency and failure.

The Paine Vice Grip Rail Anti-Creeper, illustrated herewith, has recently been marketed by T. L. Paine, Milwaukee, Wis., and consists of castings carried downward to a meeting point under the rail, thus forming a fulcrum or foot, with the bolt pulling between it, and the jaws above. The tightening of the cross bolt puts a direct and vise-like grip of the hook castings directly and squarely against the rail base, and the extent of

this grip is only limited by the power applied to the bolt. Instead of a weakening tendency to draw downward and away, the result is a direct, powerful and rigid clasp. The downward extension of the castings to unite underneath the rail, forms in addition a good brace and truss support to the sides, thus adding great stiffness and strength where needed, and permitting the extreme pressure of the bolt to be applied directly to the grip. Where the extension braces meet under the rail, a lug on the foot



PAINE'S VISE-GRIP RAIL ANTI-CREEPER

of one jaw engages in a socket in the other, thus holding both rigidly and in perfect position for applying quickly and easily.

These simple features make an efficient anti-creeper; combining as it does the acme of holding power on the rail, the large tie surface and stength of grip, together with ease and quickness of application.

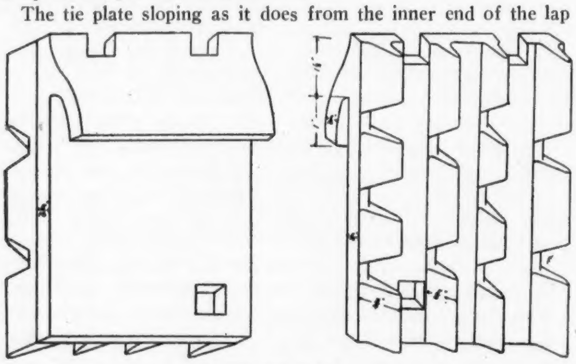
Flinn Tie Plate

A new tie plate has recently been invented by Mr. E. L. Flinn, Forestville, Ohio, and is illustrated herewith by line engraving. The following information is presented by the inventor in describing the tie plate:

The plates are to be made of soft steel 4½ inches in width, 5-16 inch in thickness, and in lengths suitable for the different size nails and angle-bars, with an over-lapping shoulder of sufficient length to serve the place of the outside spikes in holding the rail in place. The over-lap serves the place of many spikes and rail braces. On account of the inside spike holes being punched a little less than the actual width of rail base, when the inside spikes are driven down it draws the rail up tight under the over-lap, there being no lost motion between the inside spike and the shoulder, making an efficient anti-rail creeper.

It no doubt has been noticed in cases of derailment where the flanges of the derailed car follow along the outside of the rail, driving the spikes down below the base of the rail and shearing the bolts, and the cars following either spread the track, catch a lip on the joint or turn the rail.

The tie plate sloping as it does from the inner end of the lap



FLINN TIE PLATE.

to the outer end of the plate, and in cases of derailment the car wheel will slide as on a wrecking frog, out from the rail and clearing the bolts. Even though the wheels might destroy the spike in the end of the plate, the over-lapping shoulder, notched blades and inside spike are of sufficient strength to maintain a perfect gauge. It will be noticed in the construction of this plate there is a notch at the outer end for the reception of spike, instead of a hole being punched through the shoulder abutting against the flange of the rail, which allows 5¼ inches of a 5½ inch spike to be driven in the ties, affording greater resistance. It may be interesting to know other styles of tie plates, from ¾ inch to 1⅛ inches of the spikes stand above the ties, which gives leverage enough to cause the spikes to bend back at the top, and causes an irregularity of gauge. The bottom of the tie plate is so arranged with blades running the full length of the plate, with notches for entering the tie lengthwise of the grain. The object of these notches is for anchorage of end-wise movement. The wood entering the notches at a certain width, and as the blades are pressed into the ties, the wood is compressed at the top, forming a hard knot which holds the plates against the outward strain and maintaining a more accurate gauge than can be obtained with any other style plate. The object in staggering the notches is to re-enforce the plate from turning up at ends.

Technical Publications

"Design of a Railway Bridge Pier," by Charles Desleth, Jr., C. E., Associate Professor Structural Engineering, University of California. The Engineering News Publishing Co., paper 6¾ x 10¼ inches, 24 pages and seven illustrations in text. Price 50 cents net. (Reprinted from the "California Journal of Technology" November, 1906.) This article endeavors to cover the subject of bridge pier design in a more complete and efficient manner than any text now extant, and recognizing its value, especially to students it was thought advisable to reprint it in a permanent and available form. The paper contains information pertaining to a proposed pier including specifications, neck section of pier, illustrated, general stability, horizontal forces acting, stability of caisson-roof section, stability at bed-rock, batters and their effect on the stability of piers, flotation of caisson, weight necessary to sink caisson, design of caisson, coffer dams, shafts, locks and power plant, and bill of approximate costs.

"The Engineering Index Annual for 1906," compiled from the Engineering Magazine, New York and London. Price $2.00, cloth. It is 6½ inches by 9¼ inches and contains 395 pages. It is an index of the articles, of interest to the railroad man and engineer, that have appeared in the technical papers of this country and Europe during the year 1906. This volume is a continuation of the work originally started by the late Professor J. B. Johnson in the Journal of the Association of Engineering Societies in 1884 and turned over by that Association to the Engineering Magazine in 1895. The index covers 250 technical and engineering journals in six different languages, about one-fourth of the periodicals indexed being in languages other than English. In every case a brief abstract of the article is given with the approximate number of words, and in many instances this is sufficient for the purposes of the investigator without further reference. In general, the index is used as a guide to the vast mass of information otherwise practically buried in the numerous files of engineering publications in the reference libraries in all parts of the world. Instead of being classified alphabetically as has been done in the past, subjects are classified under the following divisions: Civil, Electrical, Mechanical, Marine and Navy, Steam and Electric Railway Engineering and Industrial Economy. The groups are subdivided according to special divisions of each field. The index is invaluable to anyone having frequent occasion to refer to engineering matters, and as it represents current practice it should be of very much greater value than before.